

RESTRICTED

A.P. 101B-0417-1A
A.L. 34, Mar. 68

SECTION 3

AIRFRAME

LIST OF CHAPTERS OVERLEAF

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SECTION 3

AIRFRAME

LIST OF CHAPTERS

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- 3 Tail unit
- 4 Flying controls
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Chapter 1 FUSELAGE

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DESCRIPTION

Introduction

1. The all-metal fuselage is circular in section and of stressed-skin construction throughout. Transport joints at frames 12 and 31 divide the fuselage into three sections, front, centre and rear. Except at the transport joints and in areas where reinforcement is necessary, the structure is supported by flanged channel-section frames which are cut-away on their outer edges to accommodate the fore-and-aft stringers. Fig.1 illustrates the disposition of the fuselage sections and frames within the structure.

FRONT FUSELAGE

General information

2. The front fuselage comprises a nose fuselage, a pressure cabin, a nose under-

carriage bay and three equipment compartments. The pressure cabin is sealed off fore-and-aft from the remainder of the fuselage by two pressure bulkheads (fig.1), the former is integral with the nose fuselage, whilst the latter, a sloping bulkhead, divides the cabin from the equipment compartments and nose undercarriage bay. A horizontal diaphragm aft of the sloping pressure bulkhead, divides the area between the bulkhead and the transport joint into an upper equipment bay and a lower compartment; the latter is divided by two vertical diaphragms to form the nose undercarriage bay and flanking compartments. A folding seat is hinged to the starboard wall of the cabin, between frames 4 and 5. ▶

3. The cabin entrance door is situated in a suitably reinforced aperture built into the fuselage structure starboard side, forward of the sloping pressure bulkhead. In a similar manner, reinforced apertures are

built into the fuselage roof, and house the canopy and crew escape hatch; the canopy aperture being additionally reinforced by a circular-section coaming tube. Two 1/8 in. dia. holes, one in the port and one in the starboard side of the tube at the lowest points, facilitate the periodic draining of any water accumulation. To prevent loss of cabin pressure, the holes are plugged with self-tapping screws dipped in Bostik sealant. In the port side of the fuselage, adjacent to the navigator's station, a perspex window is provided. In the fuselage roof, aft of the sloping pressure bulkhead, a suitably reinforced aperture houses the upper equipment bay access hatch. Apertures in the fuselage belly, and port and starboard sides, accept the nose-undercarriage bay doors, and lower equipment compartment access hatches, respectively.

4. To provide for aerial horns, clusters and waveguide switches (Sect.9,

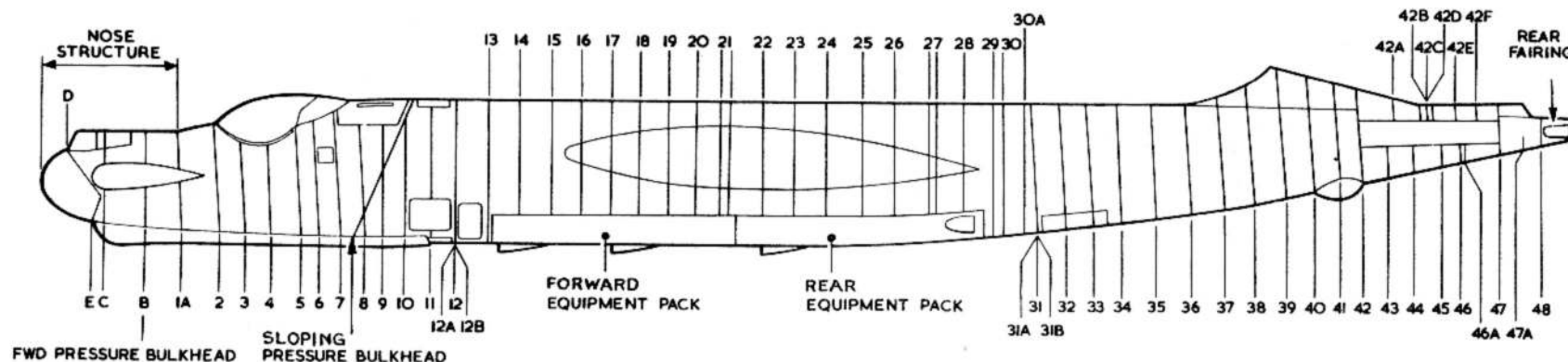


Fig.1. Key diagram

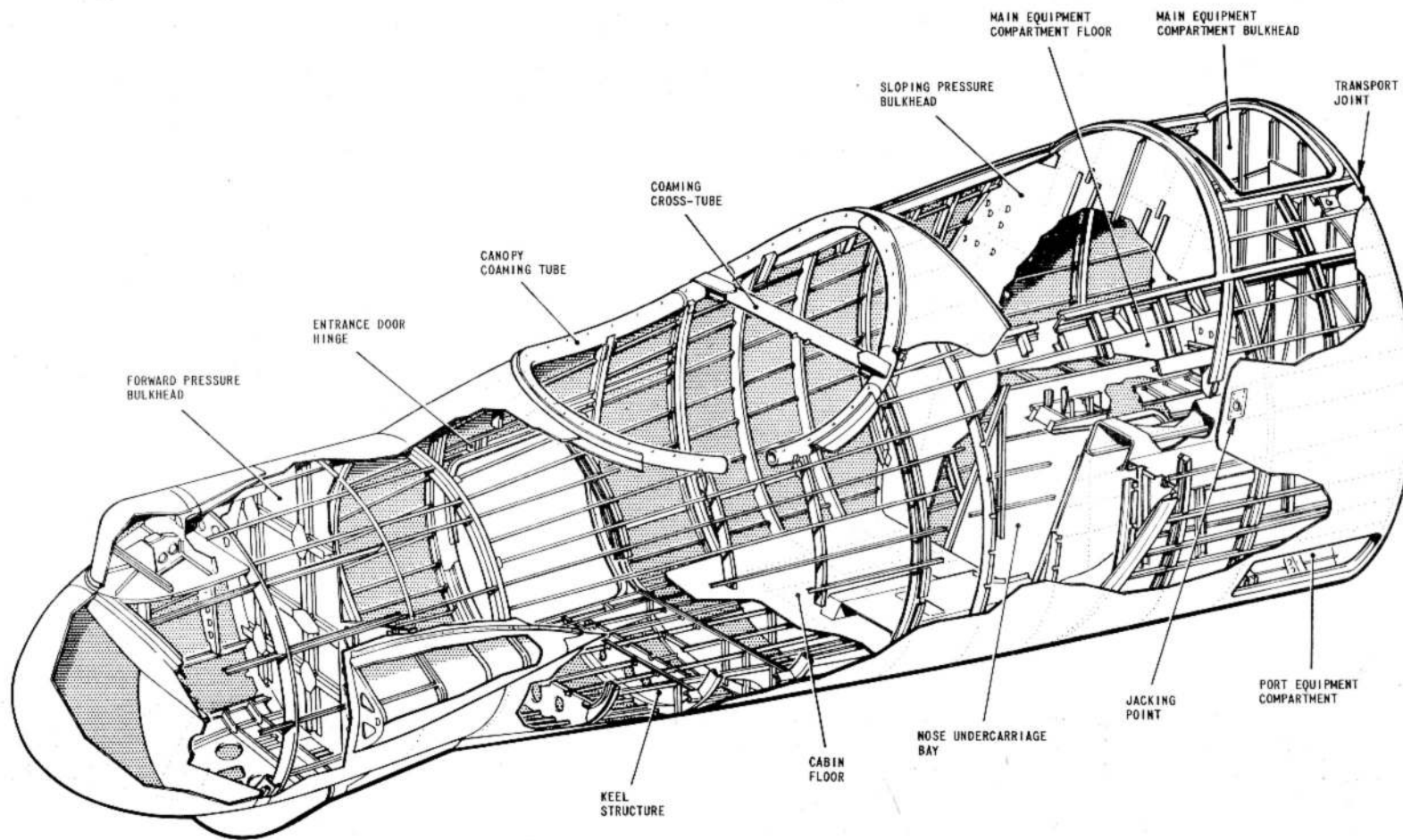


FIG. 2. FRONT FUSELAGE

Chap.4), five fibreglass detachable radomes are fitted and faired into the nose fuselage skin (fig.9). To facilitate servicing of the waveguide switches, access panels are provided on both sides of the fuselage (Sect.2, Chap.4). Two external metal ducts, one port and one starboard, emanating at the lower radome, extend aft to the nose undercarriage bay to house the waveguides.

Cabin floor

5. The cabin main floor extends forward from the sloping pressure bulkhead to frame 1. A built-up structure at the pilot's station forms the pilot's floor and raises his seat above the level of the main floor.

Canopy

6. The canopy consists of two blown transparent plastic sheets forming a sandwich and separated by an edge spacing piece. Two aeri-als (redundant) are suppressed within the sandwich, and a hinged direct-vision window of laminated glass is fitted to the port forward face. The canopy is secured to the coaming tube surrounding the fuselage aperture, by thirty-two explosive attachment bolts.

Crew escape hatch

7. The crew escape hatch is of metal construction reinforced on the inside by two channel-section cross-members and angle-section stringers, and is secured to the fuselage cut-away section boundary member by thirty-four explosive attachment bolts. The hatch is provided with two flush-fitting transparent plastic windows, and two

secondary firing cable attachment brackets.

Equipment compartments

8. Three equipment compartments are located between the cabin pressure sloping bulkhead and the transport joint at frame 12. The upper compartment is situated above the nose-undercarriage bay, the bay roof forming the compartment floor; access to this compartment is gained through a hinged hatch situated in the fuselage roof. The two remaining compartments, one on each side of the nose undercarriage bay, are formed by the sides of the bay and the fuselage skin; each compartment has an access door hinged at its lower edge to the fuselage side.

Nose undercarriage doors

9. The nose undercarriage doors, comprising light-gauge inner and outer skins interspaced by channel-section members and reinforcing ribs, are attached to the fuselage by piano-type hinges.

Entrance door

10. The entrance door, comprising inner and outer skins interspaced by reinforcing formers and channel-section bracing members bounded by a channel-section frame carrying a pressure-tight seal, is attached at its top edge, to the starboard side of the fuselage by two hinges. The door jettison mechanism is described and illustrated in Chap.11.

Seat guide rails

11. The pilot's ejection seat guide rail is secured at two points to longitudinal

channel-section members on the pilot's floor, and at two points, to brackets on the canopy coaming cross-tube. The navigator's and A.F.O.'s. ejection seat guide rails are each secured at two points on the sloping pressure bulkhead forward face, and at angle-section brackets on the cabin floor.

CENTRE FUSELAGE

General information

12. The centre fuselage comprises upper and lower compartments divided longitudinally by an arched floor. The upper compartment houses fuel tanks; the lower compartment forms the pack bay. The effective structure consists of the portion above the tank floor. It is of double skinned stressed-skin construction with rolled Z-section stringers stiffening both the outer and inner skins. Transverse channel-section girders, the lower ends of which form the pack-bay aperture skirt contour, provide the main support for the arched fuel tank floor; secondary support is provided by fore-and-aft channel-section members. The battery compartment is situated in the fuselage lower compartment, between the forward transport joint and the pack bay forward bulkhead. Access to the batteries is through a door in the port side. For inspection of the main plane front spar attachment points, removable panels are provided in the fuselage skin between frames 17 and 18.

Fuel tank compartments

13. Two fuel tank compartments - one forward and one aft of the bulkhead at

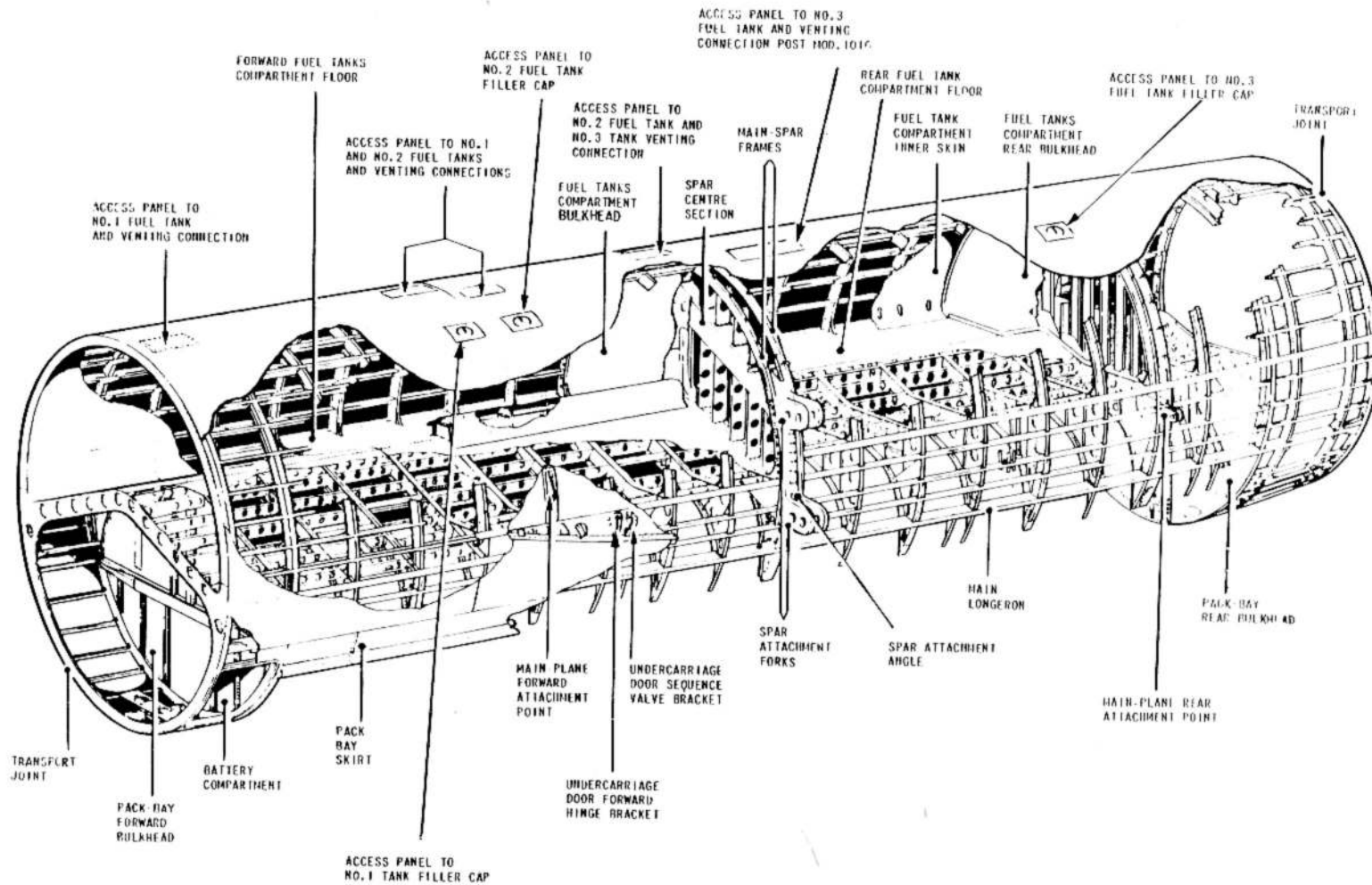


FIG. 3. CENTRE FUSELAGE

frame 21 (spar frame) – occupy the fuselage upper half, and extend from frame 12 to frame 29. The forward compartment houses two rigid self-sealing fuel tanks, and the rear, a collapsible fuel bag. To prevent chafing the undersides of the tanks, the compartment floors are lined with alloy sheets secured by countersunk rivets. In the double-skin roof, there are eight reinforced cut-away sections, five of them accommodate fuel tank venting gallery and venting connection access panels, and three house the fuel tank filler caps (*Sect.2, Chap.4*).

Main spar centre section

14. Two reinforced frames interspaced by vertical channel-section members and skinned to form a double-plate bulkhead, continue the main spar through the fuselage. They are bounded by extruded angle-section members, and carry between them the main spar pick-ups, which have forked ends for the boom attachments, and an extruded centre for the attachment of the spar web.

Pack bay

15. The pack bay extends from frame 13 to frame 29 and is formed by the lower half of the fuselage. Both frames are of extruded channel section, the lower portion carrying a bulkhead plate reinforced by channel section stiffeners. The pack-bay aperture skirt is strengthened by longitudinally attached longerons.

Equipment packs

16. The equipment packs, two in number, are similar in design, but because of the varying contour of the fuselage profile, are not interchangeable. They fit end-to-end in the pack bay and conform to the fuselage profile.

17. Each pack is a metal-fabricated structure comprising chiefly of two main, and one intermediate sub frame, two platforms and two longerons. The two main frames constitute the ends of the pack and are interconnected to the sub frame situated in the centre, by the two platforms (one each side of the sub frame). The longerons form the top edges and mate to the pack-bay skirt longerons. The pack frames are equipped with connections for the attachment of the pack to the pack bay. Channel sections fitted to the platforms provide attachments on which equipment can be mounted. Access to the platforms is provided by four removable panels – of single skin construction – two on each side of the pack; they are attached by quick-release fasteners to the main frames, the intermediate sub frame and the longerons.

18. The forward pack is secured at its front end in the pack bay, by two machined fittings on the pack, which engage with hinged links anchored to frame 13. A strut assembly fitted diagonally between the links, absorbs the pack side-loads. The pack rear end is attached by two fork-end fittings, to adjustable eye-end fittings on a support frame assembly at frame 21.

19. The rear pack is secured at its forward end in the bay, by engagement of fork-end fittings on the pack front face, with corresponding eye-end fittings on the forward pack aft face. The rear end is attached to frame 29 in a manner similar to that of the forward pack front end. Longitudinal loads are absorbed by a tubular stay having adjustable eye-end fittings and secured diagonally between an attachment point on the aft pack centre beam, and a bracket in the pack-bay roof, forward of frame 21.

Equipment pack ram-air cooling system

20. A ram-air cooling system is incorporated within each pack structure. Cooling air is routed into the forward pack through its two central beams, whereas air is routed into the rear pack through its forward central beam only. To ensure the circulation of cooling air around the platform mounted equipment, air passage holes are positioned at intervals in the shear-web plating. A flange-shaped stack-pipe attached to the forward pack front central beam, directs cooling air on to the front transmitter. Two hooded air-outlet ducts, fitted, one at the rear end of both the port and starboard rear access panels of the rear pack, ensures that a continual flow of cooling air may pass through the two packs. By closing shutters in the air-intakes (*Sect.3, Chap.6*), the ram-air supply to the packs can be cut off.

◀ Coolanol liquid cooling system

20A. On aircraft incorporating Mod.5466 a liquid cooling system is fitted in the forward pack bay to cool the ARI.23362/0 power amplifier. The liquid is cooled by a heat exchanger mounted on the port side of the pack (*Sect.3, Chap.8E*). A removable panel on the port, forward access panel provides access to the liquid charging point and reservoir (*Sect.2, Chap.2*). ▶

Stowages

21. A stowage for six engine starter cartridges is situated between frames 30 and 31, stringers 13 and 15, starboard. A stowage to accommodate personal luggage is situated between frames 29 and 31A

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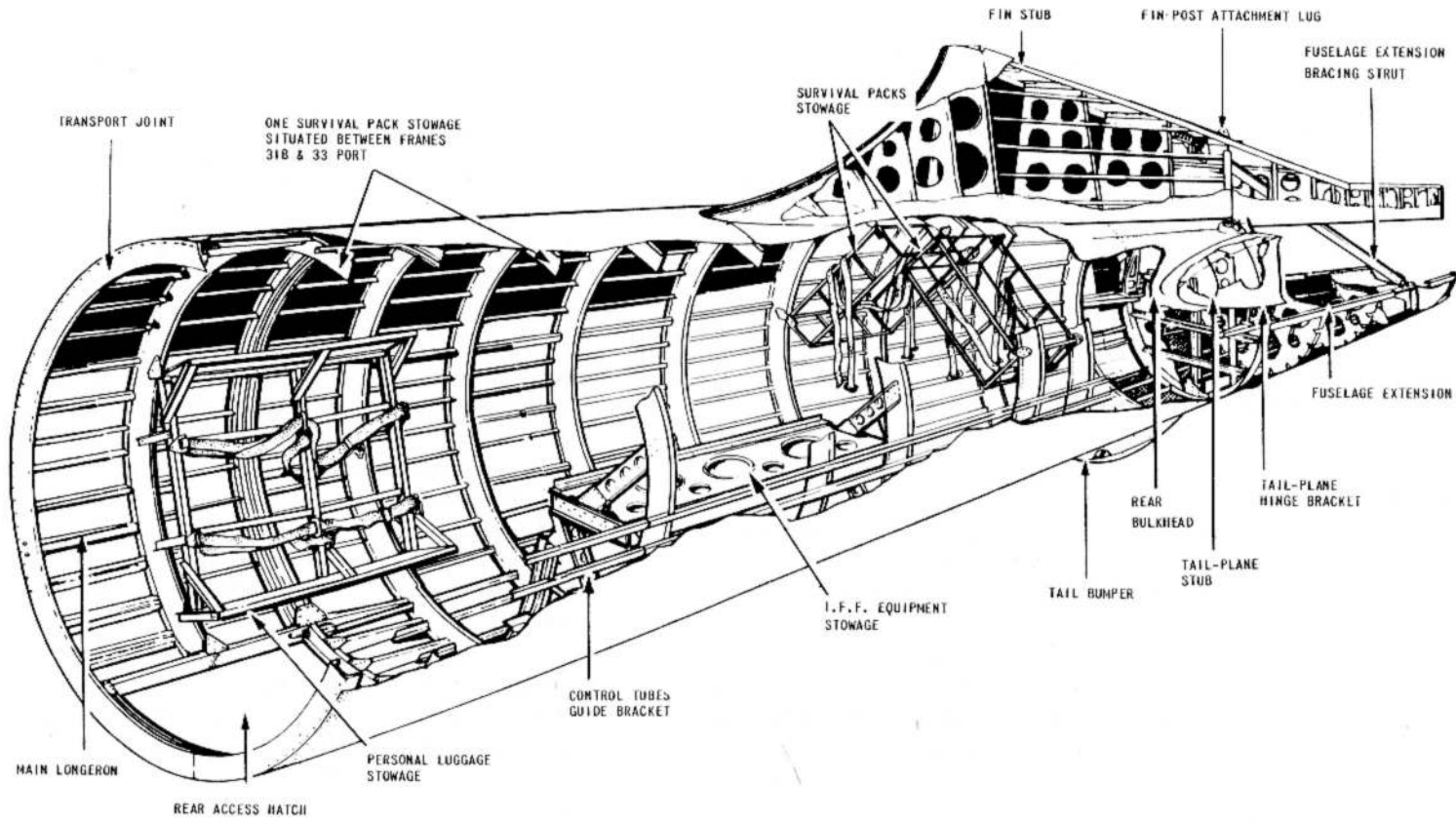


FIG. 4. REAR FUSELAGE

along the fuselage lower centre line. Access to the stowages is via the rear fuselage access hatch.

REAR FUSELAGE

General information

22. On the underside of the fuselage between frames 31B and 33, the rear access hatch, containing within its structure, a radio altimeter transmitter/receiver and aerials, is hinged to the structure, and accommodated in a suitably reinforced aperture. The hatch opens outwards and provides access to the No.3 fuel tank, radio/navigation equipment, the elevator and rudder control tubes and stowage points. A hand-rope suspended from frame 32, facilitates entry. A safety strap attached to the hatch and fuselage structure, prevents the edge of the hatch, when open, making contact with the ground. A tail bumper is fitted to the underside of the fuselage between frames 40 and 42. Forward of the tail bumper, inside the fuselage between frames 38 and 39, a guard is fitted to protect the coupler unit of the Omega aerial (post Mod.5466). ▶

Stowages

23. Stowages to accommodate three survival packs are provided. One is situated between frames 31B and 33 port, and one each at port and starboard between frames 36 and 37. The three stowage positions are indicated on the fuselage skin outer surface. A stowage to accommodate personal luggage is situated between frames 31B and 33 starboard. A stowage for picketing eye-bolts is situated at frame 32 port immediately above the rear access hatch aperture.

Tail plane attachments

24. An extension to the lower half of the fuselage aft of frame 42 and extending to frame 46, forms a platform for carrying the variable-incidence tail plane and its electrical actuator; it is braced by a diagonal strut extending from the top of frame 42 to the rear of the extension. Attached to the rear of frame 42 are two brackets which carry the tail plane pivot pins. On each side of the fuselage, extending forward of frame 42 is a narrow integral tail plane leading-edge stub.

Fin stub and fin attachments

25. Attached to the top of the fuselage structure, between frames 37 and 42, are eight diaphragms which form the fin stub structure. Four of the diaphragms above frames 39 and 42 are reinforced by longitudinal

angle-section members. The diaphragm at frame 42 carries the fin-post attachment lug. On the diaphragms at frames 39 and 42A, secondary attachment points for the fin are provided.

Rudder stub

26. The top of the fuselage structure is extended aft of frame 42 to form the rudder stub. The extension being formed by six angle-section webbed frames and four longitudinal angle-section members; the resulting box is, on each side, plated with skinning.

Rear fairing

27. The rear fairing is a metal-fabricated structure covered by a skin and forms a removable extension to the rear fuselage. Two cut-outs, one each side of the fairing, allow for the installation of aerial horns and waveguides, and are covered by detachable fibreglass radomes faired into the skin profile. A clasp-type aerial is enclosed in the extreme rear of the structure (*Sect.9, Chap.4*). The fairing is attached to the fuselage at frames 42F and 46. For its removal, refer to fig.11.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

Air-intake shutters jack adjustment

28 With the jack fully retracted, the correct distance between the pin centres is 5.50 in. \pm 0.10 in. (*fig.5*). This is a manufacturer's setting which should not normally need attention. If adjustment should be necessary:—

- (1) Remove the locking wire from the locknut at the jack piston rod fork end, and slacken the locknut.
- (2) Adjust by turning the fork end.
- (3) Check for safety, tighten the locknut and lock it with new locking wire D.T.D.189A, 22 s.w.g. ◀

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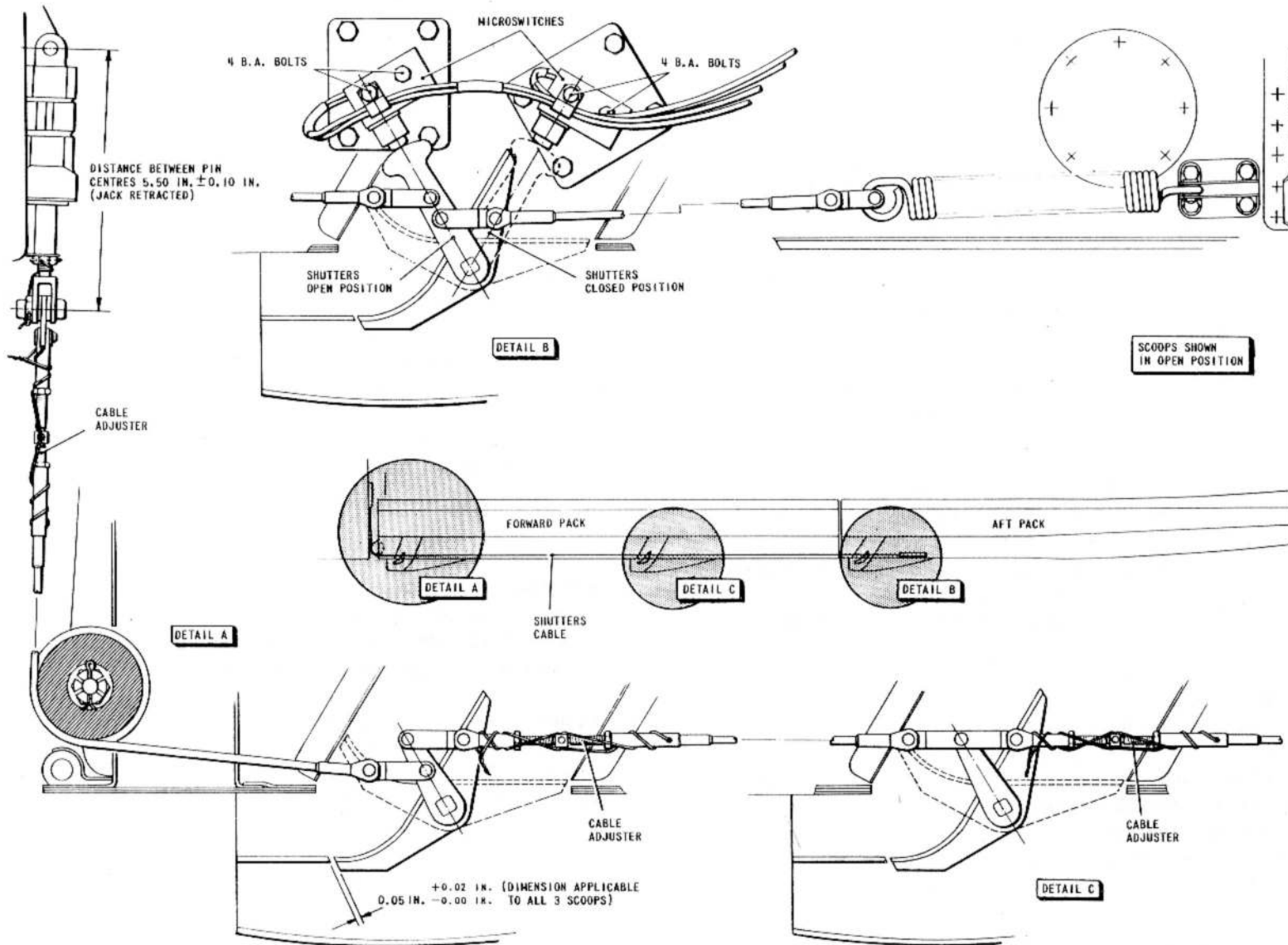


FIG. 5. AIR-INTAKE SHUTTERS AND MICROSWITCHES ADJUSTMENT

Air-intake shutters adjustment

29. To adjust the air-intake shutters:-

- (1) Remove, from the two equipment packs, the port and starboard access panels.
- (2) Connect electrical servicing trolley Ref.No.4F/1913, and select the shutters switch to OPEN (*Sect.3, Chap.6*).
- (3) Using the hydraulic system hand pump (*Sect.3, Chap.6*), fully retract the shutters jack.
- (4) Set each shutter in turn to the dimensions in fig.5 by means of the cable adjuster on the associated shutter cable assembly.
- (5) Close, and then open, the shutters, and recheck the dimensions.
- (6) Check that the cable adjusters are in safety and wire-lock.
- (7) Refit the access panels.

Air-intake shutters microswitch adjustment

30. To adjust the air-intake shutters microswitches:-

- (1) Remove, from the two equipment packs, the port and starboard access panels.
- (2) Adjust the air-intake shutters (*para.29*).
- (3) Select the shutters switch to OPEN (*Sect.3, Chap.6*) and, using the hydraulic system hand pump, fully open the shutters.
- (4) Slacken the forward microswitch adjustment bolts and position the switch so that it is operated by the shutter lever (*fig.5*). Tighten the adjustment bolts.
- (5) Select the shutters switch to CLOSED (*Sect.3, Chap.6*) and using the hydraulic system hand pump, fully close the shutters.

- (6) Repeat op.(4) on the aft microswitch.
- (7) Function-check the shutters indicator lights (*Sect.3, Chap.6, para.31(4)*).
- (8) Refit the access panels.

Lubrication

31. Refer to fig.5A.

REMOVAL AND ASSEMBLY**General information**

32. Only the removal operations are given in detail, as the assembly is generally a reversal of this procedure; where otherwise the difference is noted.

Canopy*Removal*

- ◀ 33. To remove the canopy refer to A.P.101B-0400-6, Pt.1, Chap.2.

Assembly (fig.6)

34. To assemble the canopy refer to A.P.101B-0400-6, Pt.1, Chap.2.

Fitting a new canopy

35. The procedure for fitting a new canopy is described in A.P.101B-0400-6, Pt.1, Chap.2.

Fitting a canopy D.V. window

36. The procedure for fitting a D.V. window is described in A.P.101B-0400-6, Pt.1, Chap.2. ▶

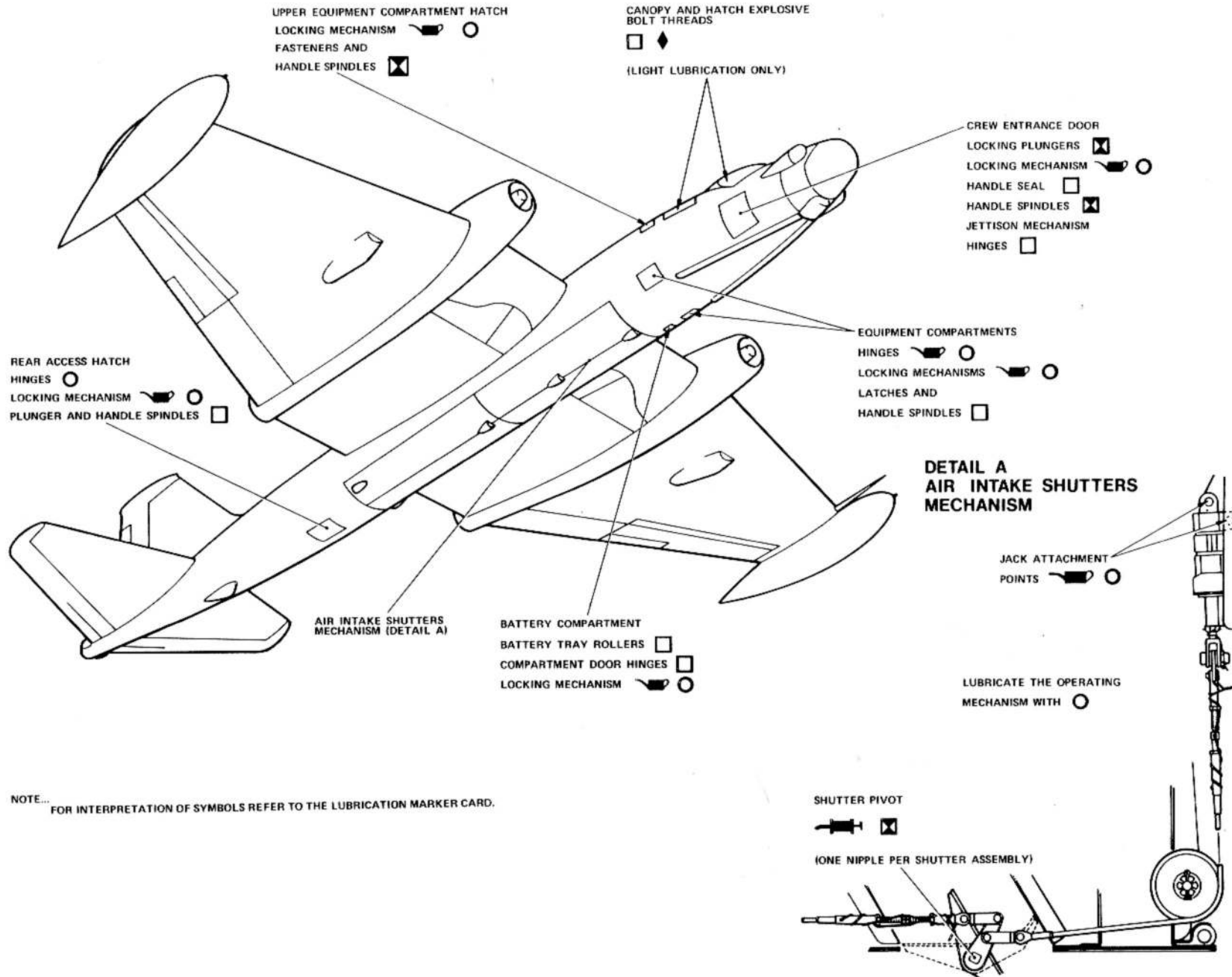


FIG. 5A LUBRICATION DIAGRAM

Crew escape hatch (fig.7)**Removal**

37. To remove the crew escape hatch:-

WARNING . . .

The relevant safety precautions detailed on the **LETHAL WARNING** marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

- (1) Disconnect, from the hatch rear interior, the two ejection seat secondary firing cables.
- (2) Remove the 2 B.A. countersunk bolts, washers and stiffnuts securing the canopy rear fairing to the fuselage. Remove the fairing.
- (3) Remove the sixty-eight ¼ in. attachment screws securing the hatch to the bolt frame.
- (4) Disconnect the butt connector and remove the hatch, first easing it up at the forward edge to allow the screwed spigots to clear the sockets in the bulkhead.

Assembly (fig.7)

38. To assemble the crew escape hatch:-

- (1) Ensure that the sealing strip and pressure seal are secure and in good condition.
- (2) Place the hatch in position on the bolt frame and, taking care not to trap the seal irregularly, secure the hatch with the sixty-eight bolts in sequence; aft centre, front centre, outwards to the sides of the hatch, and finally along the longitudinal edges.
- (3) When all the bolts have been fitted, finally tighten them, using equal pressure.
- (4) Screw down each hatch spigot until the spigot shoulder butts firmly against the pressure bulkhead forward face. Without altering the spigot setting, tighten the locknut.

- (5) Align the butt connector faces, and, using spring balance ◀ Ref.No.1A/4225, adjust the pressure between them to 12 lbf/in². ▶

(6) Reconnect the two ejection seat secondary firing cables to the hatch.

(7) Refit the canopy rear fairing.

(8) Pressure test the cabin (Chap.8).

Note . . .

1. Fitting an explosive bolt, lubricate its threads with a thin coating of grease XG-287. Ensure that the correct nut Ref.No.28M/10333 is fitted, and that the appropriate distance tube is used as instructed in ◀ A.P.101B-0400-6, Pt.1, Chap.2. The torque applied to tighten the bolts must not exceed 130 lbf/in. ▶
2. When fitting detonators into the explosive bolts (A.P.110N-0306-1), it is important that the detonator Ref.No.12G/1278, the distance tube Ref.No.26FZ/1807 and the spring Ref.No.26FZ/1579 be assembled as shown in fig.7. Prior to inserting the spring and screwing the cap home, check the dimension between the distance tube and the end of the bolt using a gauge of local manufacture; this should be 0.38 ± 0.04 in.
3. Ensure that the detonator leads are not trapped between the bolt retaining nuts and the adjacent structure.

Fitting a new crew escape hatch

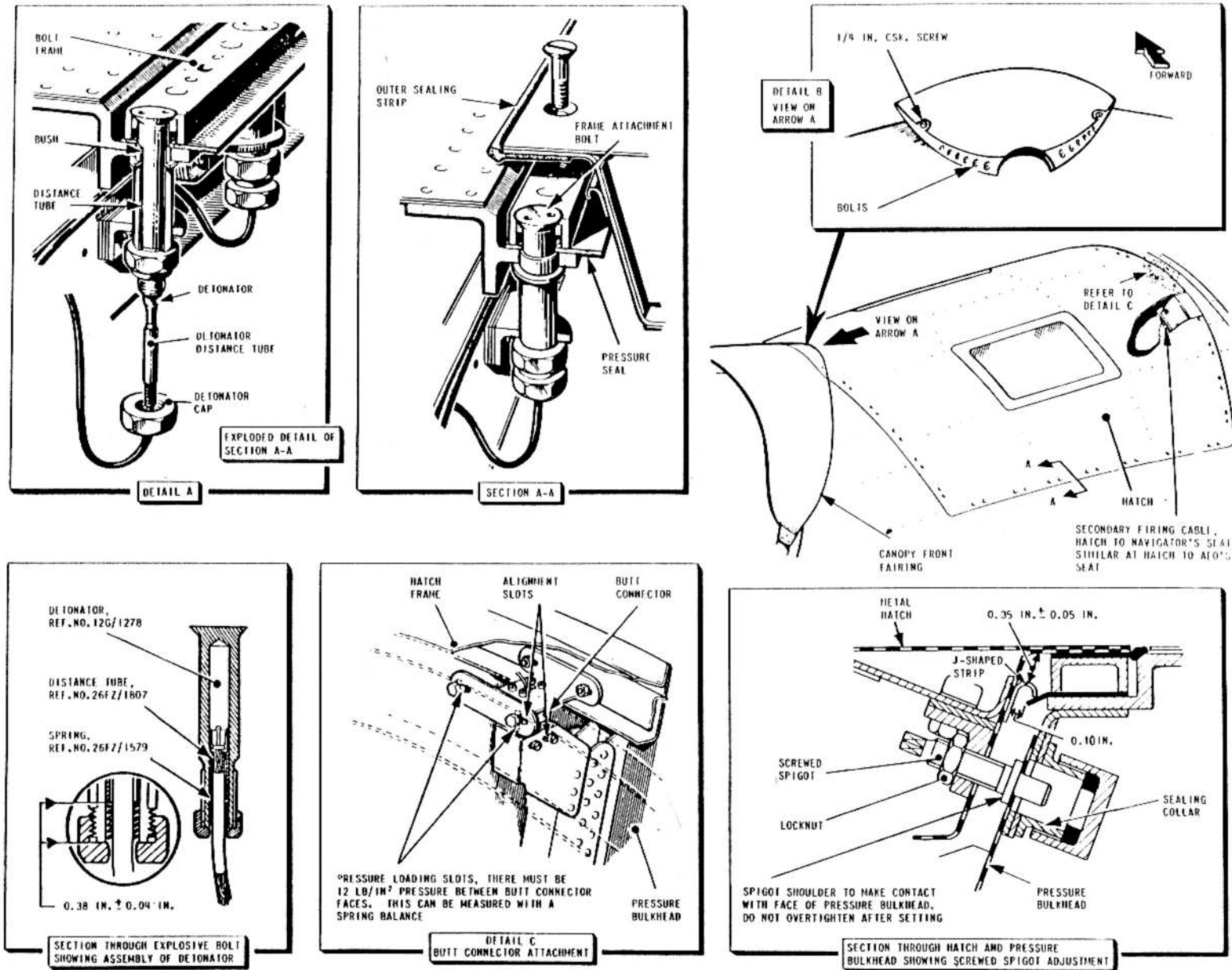
- ◀ 39. This is described in A.P.101B-0400-6, Pt.1, Chap.2. ▶

Air-intake shutters jack**Removal**

40. To remove the jack:-

- (1) Remove the forward equipment pack access panels (Sect.2, Chap.4).

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FIG. 7. CREW ESCAPE HATCH - REMOVAL AND ASSEMBLY

(2) Exhaust the hydraulic system of all hydraulic pressure (*Chap.6*). Disconnect the hydraulic pipes from the jack. Blank off the open ends of the pipes and the apertures in the jack.

(3) Disconnect the shutters cable from the lower end of the jack by removing the split pin, washer and shackle pin.

(4) Disconnect and remove the jack by removing the split pin, washer and shackle pin at its upper end, and the bolts, stiffnuts and strap assembly at the jack body. Retain all fittings with the exception of the split pins.

Assembly

41. To refit the jack, reverse the removal operations (*para.40, with the exception of op.(2)*); fit new split pins in place of the discarded ones. Bleed the hydraulic system (*Sect.3 Chap.6*).

Equipment packs (*fig.8*)

Removal

42. The rear pack must be removed first.

(1) Remove the four access panels from each of the two packs.

(2) Disconnect all electrical cables at the two packs and remove the A.R.I. units from them (*Sect.9, Chap.4*).

(3) Disconnect the air-intake shutters cable at the jack (situated at frame 13 aft face).

(4) Disconnect the cable linking the

rear pack shutter to the forward pack aft shutter.

(5) Disconnect the six pack-to-fuselage earth leads from the fuselage.

(6) Position trolley Ref.No.26FZ/95083 to take the weight of the rear pack.

(7) Disconnect the stay assembly lower end (*detail C*) from the rear pack.

(8) Remove the fittings securing the rear pack to the lower ends of the links (*detail A*).

(9) Remove the two quick-release pins securing the rear pack to the forward one (*detail B*).

(10) Transport the rear pack from the fuselage.

(11) Position trolley Ref.No.26FZ/95083 to take the weight of the forward pack.

(12) Remove the fittings securing the forward pack aft end to the support frame assembly (*detail D*).

(13) Remove the fittings securing the forward end of the pack to the lower ends of the links (*detail A*).

(14) Transport the forward pack from the fuselage.

Assembly

43. The forward one must be installed first. Installation is the reverse of removal. New split pins must be used.

Nose fuselage

Detachable radomes

44. Removal.- Refer to fig.9. Remove any or all of the five radomes by unscrewing the associated retaining bolts.

45. Assembly.- Assembly of the radomes is the reverse of removal.

Waveguide detachable panels and ducts

46. Removal.- Refer to fig.9. Remove the panels and/or ducts by unscrewing the associated retaining bolts.

47. Assembly.- Assembly of the panels and/or ducts is the reverse of removal.

Rear fairing

Detachable radomes

48. Removal.- Refer to fig.10. Remove either or both the radomes by unscrewing the associated retaining bolts.

49. Assembly.- Assembly of the radomes is the reverse of removal.

Fitting a crew entrance door

50. To fit a crew entrance door:-

(1) Rotate the door jettison handle clockwise to its full extent.

(2) Line up the free hinge pin cups so that their slots are in line with the slots in the shaft hinge-pin cups.

(3) Offer up the door to the fuselage and insert the hinge pins into the hinge-pin cups.

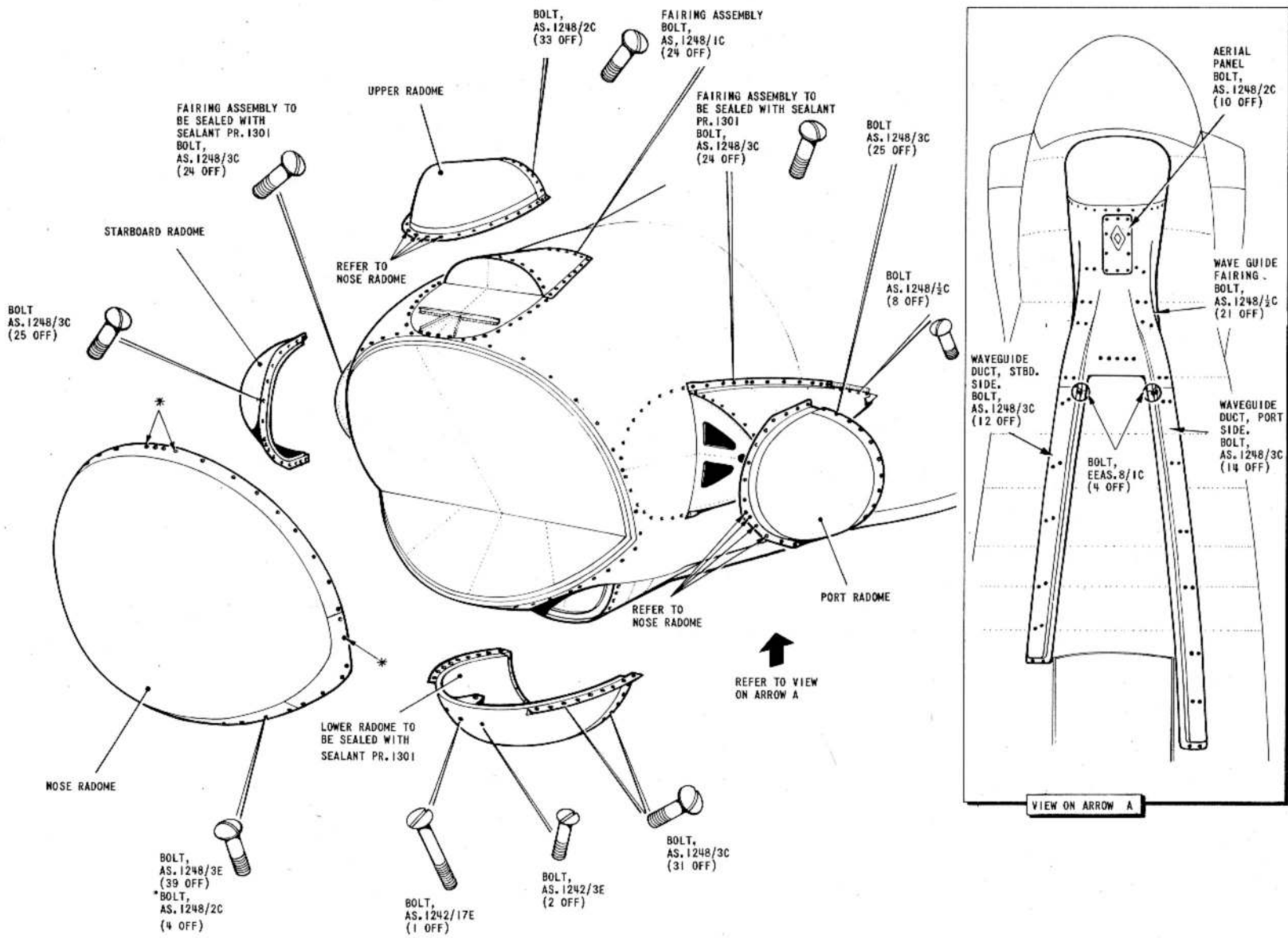


FIG.9. FRONT FUSELAGE - DETACHABLE RADOMES, PANELS, FAIRINGS AND DUCTS

(4) Rotate the jettison handle counter clockwise to its full extent ('safe' position), and secure the handle with its retaining strap (the handle requires approximately four complete revolutions to rotate the hinge-pin cups from the 'jettison' to the 'safe' position, or

vice versa). Check that the cups are in the 'safe' position.

51. The procedure for fitting a new crew entrance door is described in A.P. 101B-0400-6, Part 1.

Slinging

52. Refer to fig.12 and 13.

Trestling

53. Refer to Sect.2, Chap.4. Trestle Reference Numbers are also given in that chapter.

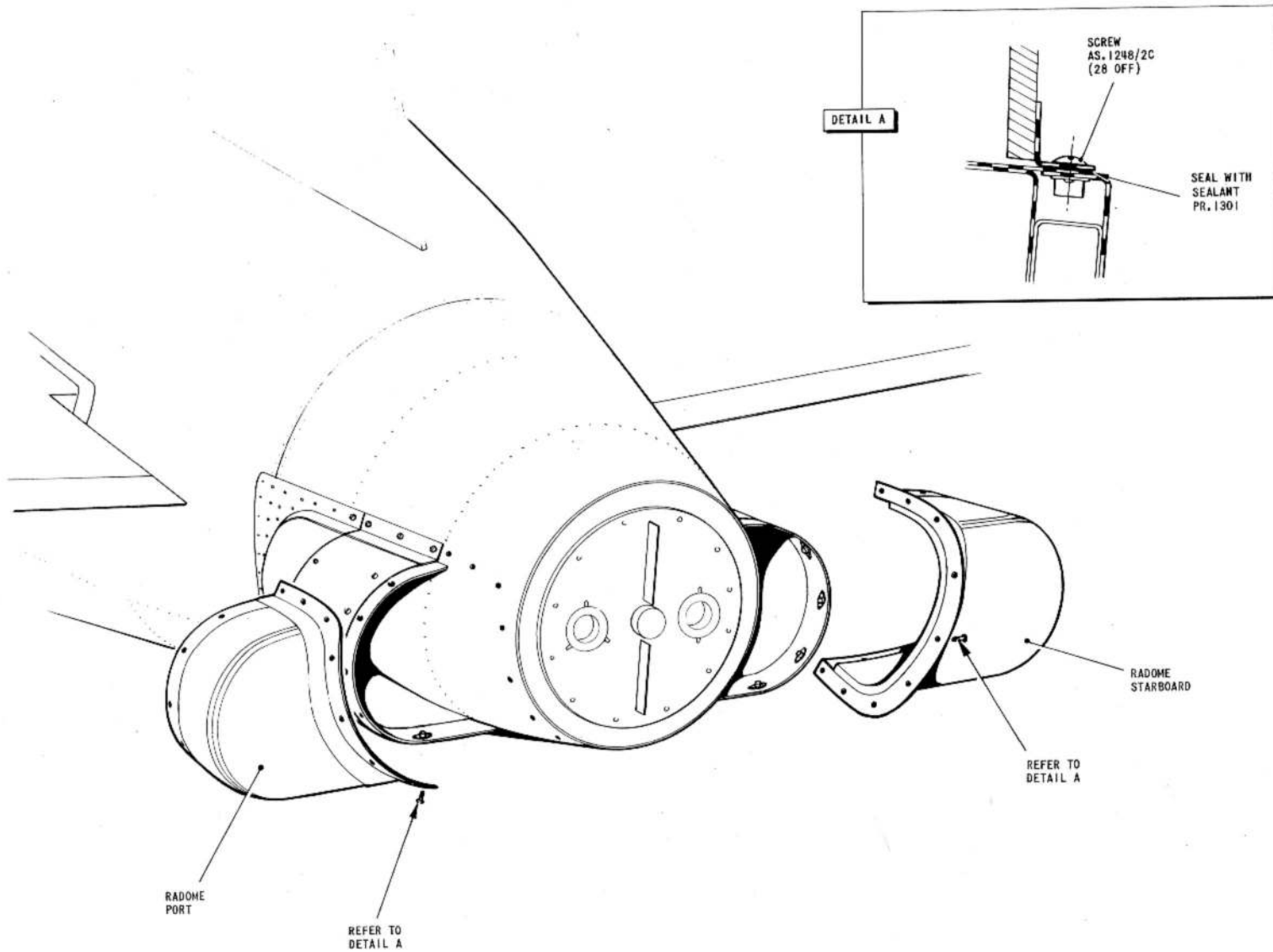


FIG.10. REAR FAIRING-DETACHABLE RADOMES

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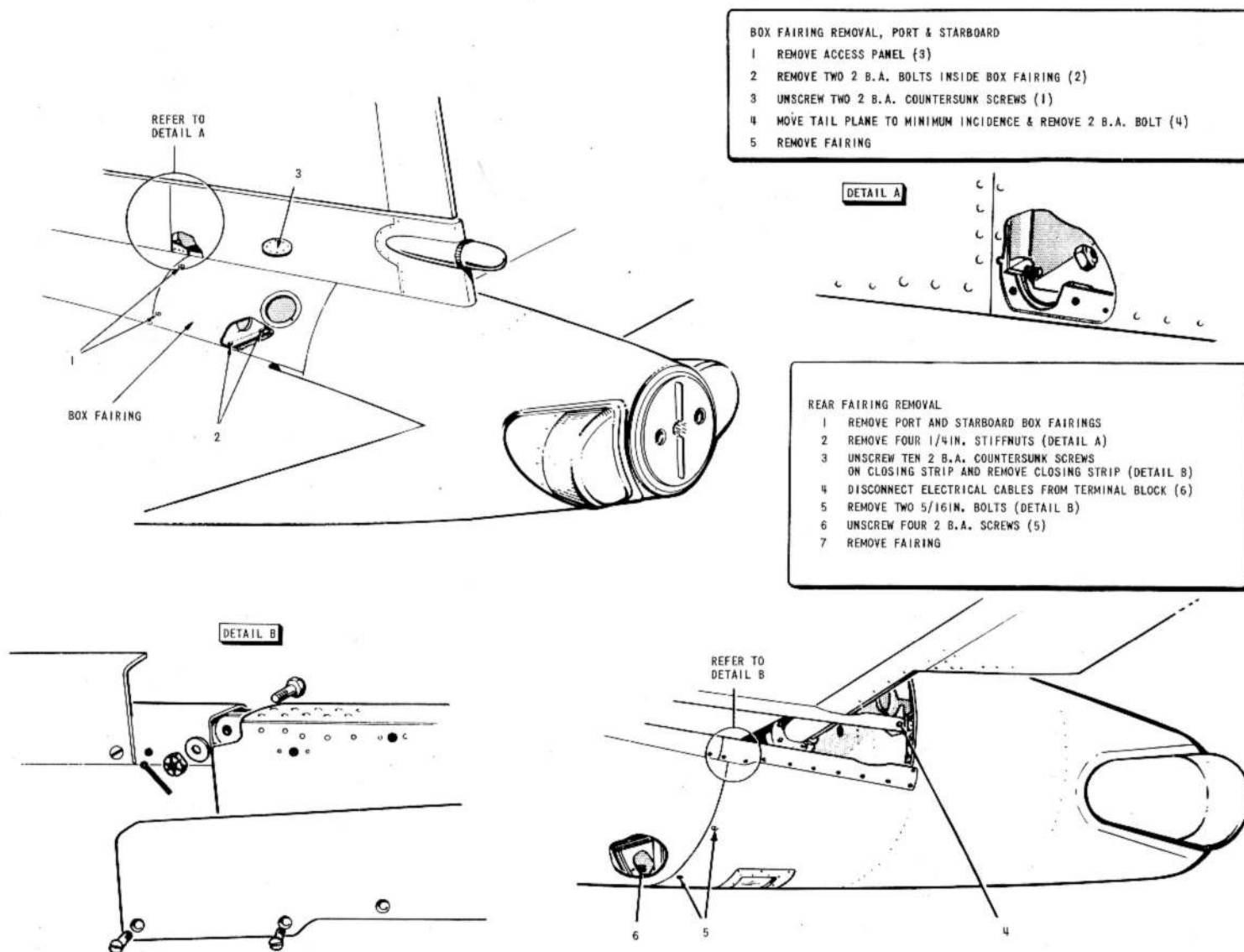


FIG.11. REAR FAIRING-REMOVAL

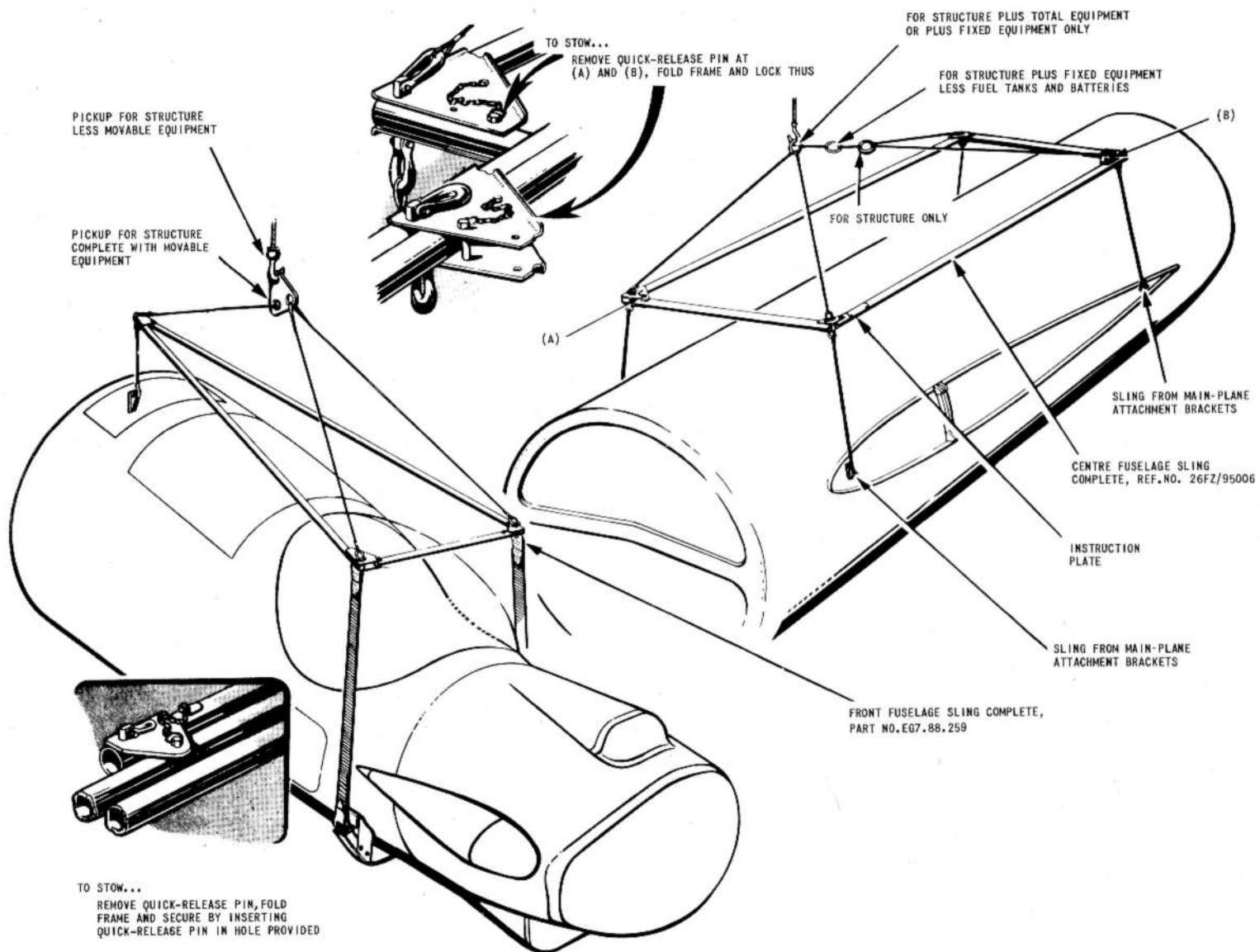


FIG. 12. SLINGING-FRONT AND CENTRE FUSELAGE

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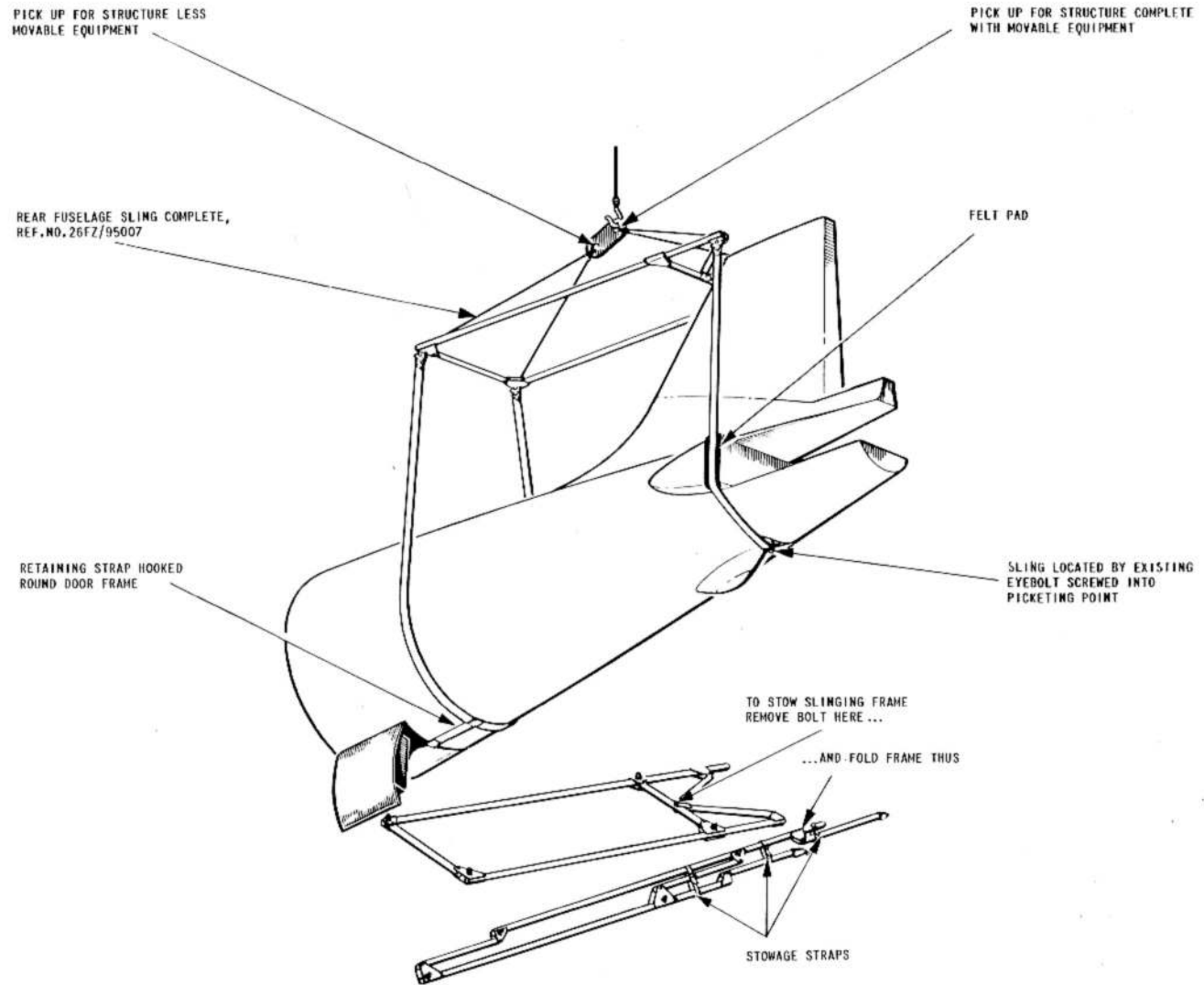


FIG. 13. SLINGING - REAR FUSELAGE

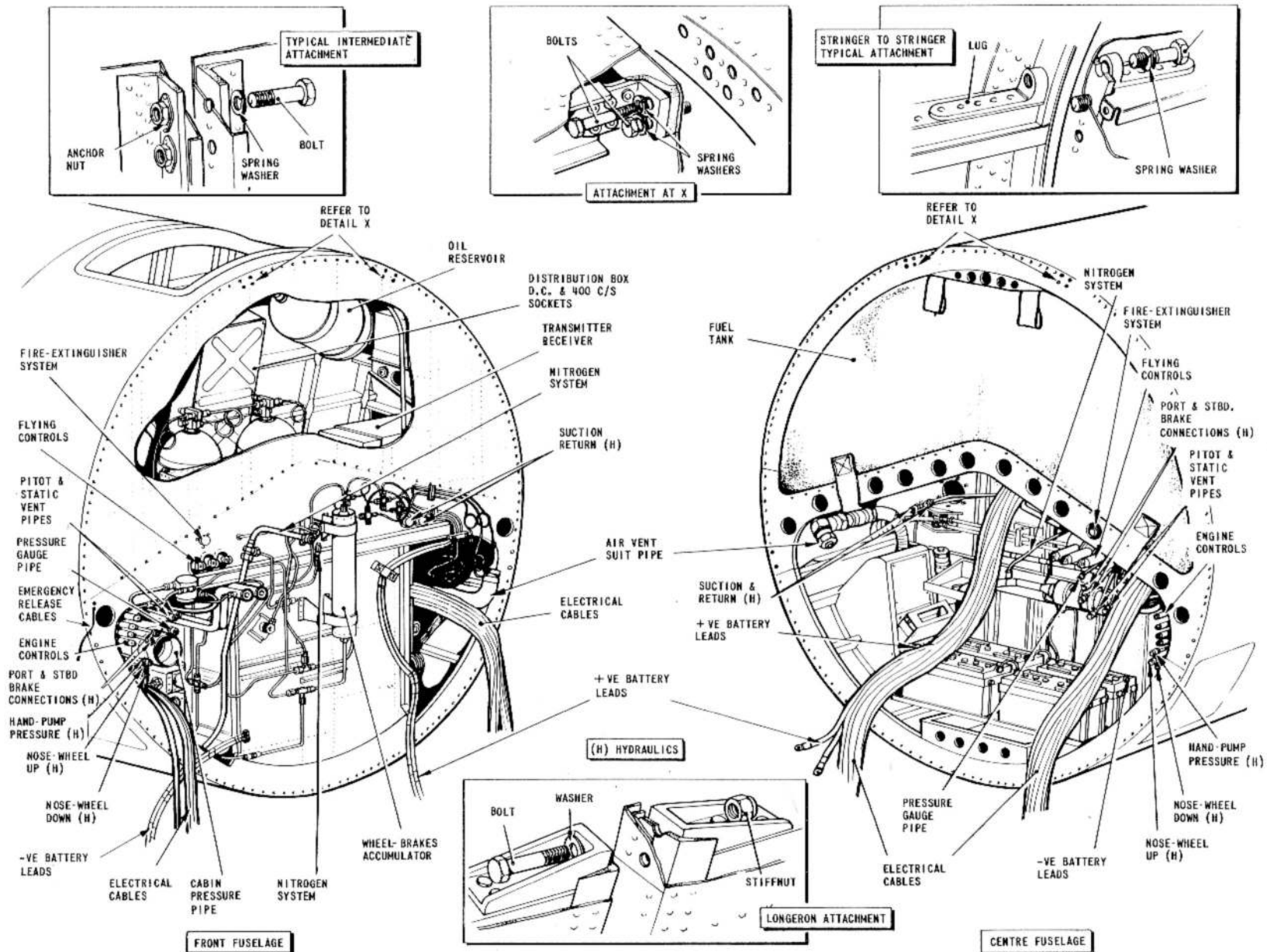


FIG. 14. FRONT FUSELAGE-REMOVAL

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KEY TO FIG.14 (FRONT FUSELAGE - REMOVAL)

To remove the front fuselage from the centre fuselage:-

(1) Jack and trestle the aircraft (Sect.2, Chap.4).

(2) Remove the equipment compartment hatch and attach the sling to the front fuselage (fig.12). Take up any slackness in the sling by the hoist.

(3) Disconnect the battery leads and remove the batteries.

(4) Disconnect the detonator circuit fuses.

(5) Disconnect all electrical cables entering the equipment compartment from the centre fuselage.

(6) Disconnect and blank off the following hydraulic system connections:-

- (a) Wheel brakes accumulator.
- (b) Port and starboard wheel brake connections.
- (c) Nose undercarriage ground selector
- (d) Suction and return pipes.
- (e) Pressure pipe.

(7) Disconnect and blank off the pressure head and static vent pipes.

(8) Disconnect the connections of the following controls, services and systems:-

- (a) Flying controls tubes.
- (b) Engine control tubes.
- (c) Fire extinguisher system pipe.
- (d) Alighting gear emergency release cable.
- (e) Cabin pressure pipe.

◀ (f) *deleted* ▶

Note...

All controls, services and systems are to be disconnected at the points illustrated.

(9) Remove the 31 bolts attaching the centre fuselage end floor member to the equipment bay bulkhead.

(10) Remove the two bolts from the centre vertical stiffeners on the upper portion of the equipment bay bulkhead (bolt D, fig.15).

(11) Remove the 84 intermediate attachment bolts.

(12) Remove the 84 stringer attachment bolts.

(13) Remove the two attachment bolts from each longeron. The front fuselage is now free. Lower it on to the trolley (Sect.2, Chap.4).

Reassembly notes...

1. *Before reassembly, clean the surfaces of the transport joint frames, apply pigmented varnish jointing compound Ref. No. 33H/2202110 between the frame inner edges and the bolt holes, and glazing compound Ref. No.33H/9704973 between the frame outer edges and the bolt holes. No jointing or glazing compound must enter the holes.*

2. *The flying control tube fork-end fittings, are, at the bolt hole in the lug outer faces, machined with a counterbored recess. This recess is designed to accommodate the nut.*

3. *Engine control rods must be reconnected with the shackle pin heads uppermost. On completion of reconnection, ensure that there is no possibility of a foul occurring between rods, or between rods and fuselage structure.*

- NOTE...
- 1 STARBOARD SIDE OF FRAME SIMILAR TO PORT SIDE.
 - 2 *ALTERNATIVE STRINGER READING (1) to (40)
 - 3 BOLTS TO BE FITTED WITH HEADS AT THE FRAME FORWARD FACE.
 - 4 WASHERS TO BE FITTED UNDER THE BOLT HEADS, INCLUDING THOSE AT SYMBOL C.

SYMBOL	ITEM	QTY.
A	BOLT EA1. 10. 1209	54
	WASHER AGS. 163/E	54
B	BOLT EA1. 10. 1207	111
	WASHER AGS. 163/D	111
C	BOLT A. 25/15N	4
	WASHER EA1. 10. 2713	4
	WASHER SP. 15/N	4
	STIFFNUT AGS. 2001/N1	4
D	BOLT A. 25/2C	2
E	BOLT A. 25/2C	1
	WASHER AS. 470/C	1
G	BOLT A. 25/2C	12
	WASHER AS. 470/C	12
H	BOLT A. 25/1C	18
	WASHER AS. 470/C	18

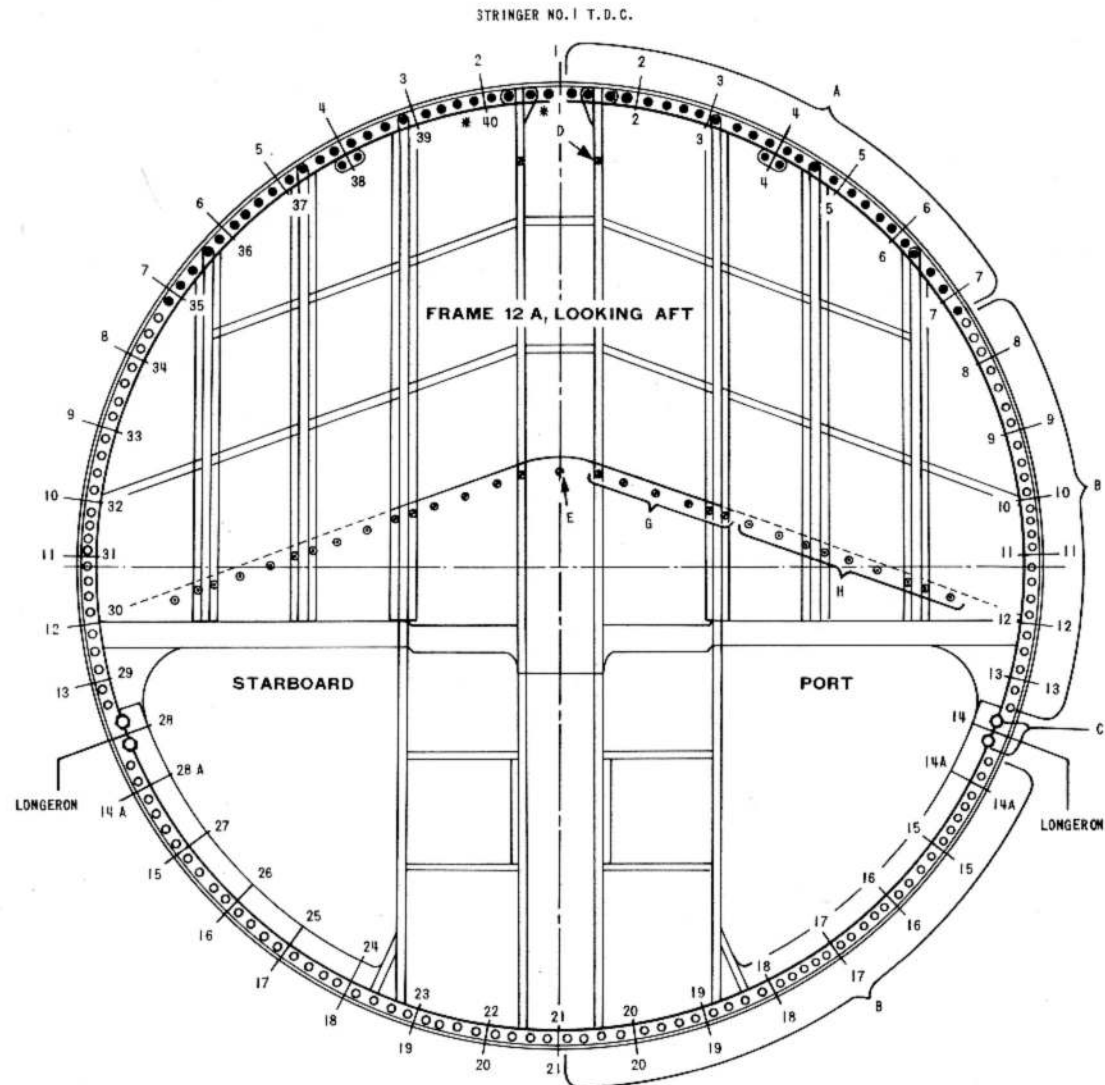


FIG. 15. ATTACHMENT BOLT DETAILS - FRONT-TO-CENTRE FUSELAGE

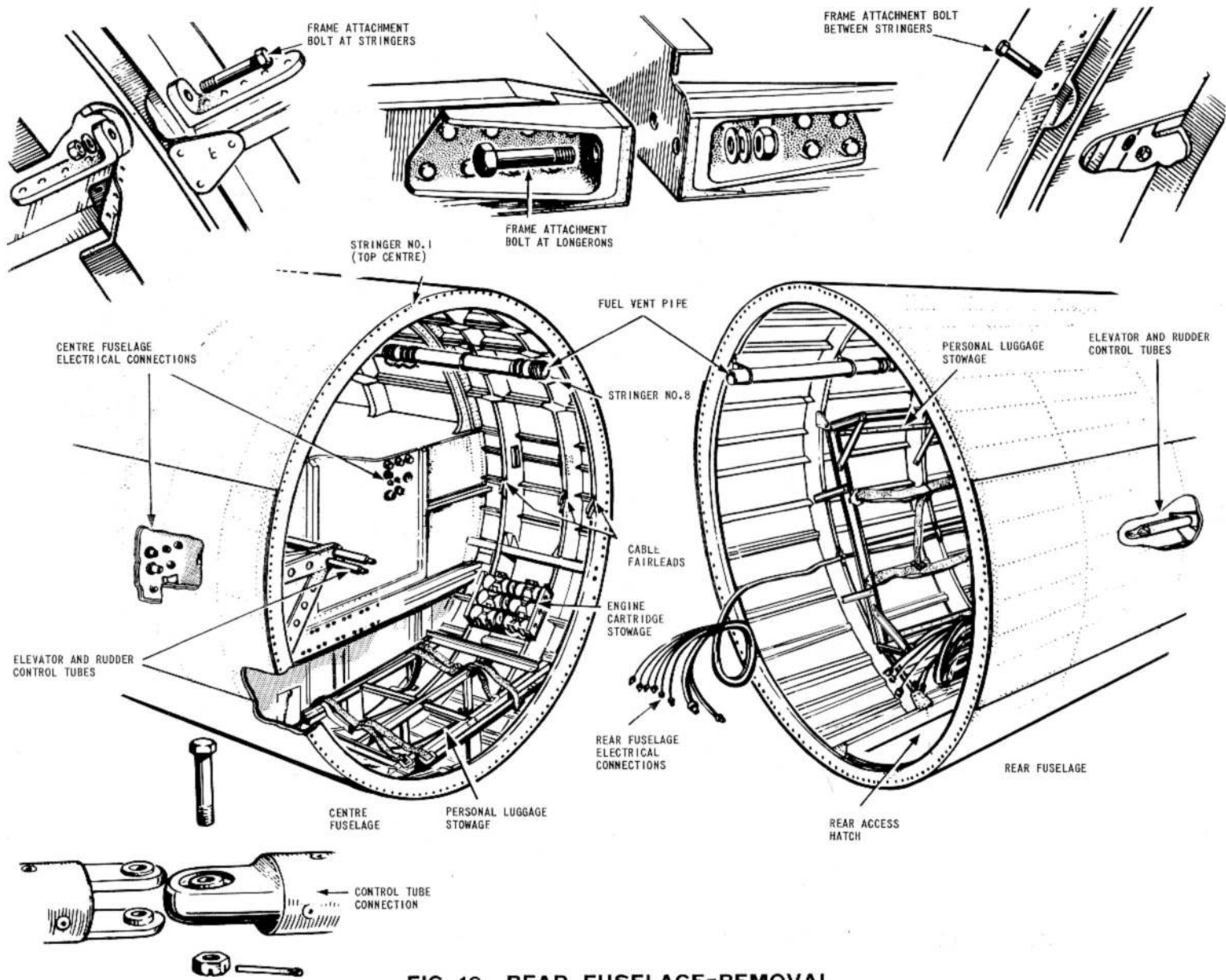


FIG. 16. REAR FUSELAGE-REMOVAL

KEY TO FIG. 16 (REAR FUSELAGE - REMOVAL)

To remove the rear fuselage from the centre fuselage:-

(1) Jack and trestle the aircraft (Sect. 2, Chap. 4).

(2) Attach the sling to the rear fuselage (fig. 13). Take up any slackness on the sling.

(3) Disconnect all electrical supplies.

Note...

Access to all connections and attachment bolts is gained through the access hatch in the undersurface of the rear fuselage.

(4) Disconnect the electrical cables at the plug and socket connections on the bulkhead at frame 29 and stow them carefully in the rear fuselage.

(5) Disconnect the elevator and rudder control tubes in the fuselage, port side.

(6) Disconnect and blank off the fuel vent pipe on the fuselage, starboard side.

(7) Remove the stiffnuts and washers from the 80 frame-attachment bolts between the stringers. Remove the bolts.

◀ **Note...**

Where a notice referring to Repair Leaflet B4/1 is painted inside the fuselage adjacent to stringer 13, longer bolts Part No. A25/

14E will have been fitted at the rear transport joint adjacent to stringers 12 and 13. The position of these bolts must be noted on removal.

(8) With the exception of those at stringer 1 and stringer 8 port and starboard, remove the stiffnuts and washers from the remaining 74 frame-attachment bolts on each side of the stringers. Remove the bolts.

(9) Remove the stiffnuts and washers from the frame-attachment bolts on each side of stringer 1 and stringer 8 port and starboard. Remove the bolts.

(10) Remove the stiffnuts and washers from the frame-attachment bolts at each longeron and withdraw the bolts. The rear fuselage is now free. Lower it on to the trestles (Sect. 2, Chap. 4).

Reassembly notes...

1. Before connecting the fuel vent pipes, remove the blanking and ensure that no obstruction is present in either length of pipe.

2. Before reassembly, clean the mating surfaces of the transport joint frames, apply pigmented varnish jointing compound Ref. No. 33H/2202110 between the frame inner edges and the bolt holes, and glazing compound Ref. No. 33H/185 between the frame outer edges and the bolt holes. No jointing

or glazing compound must enter the holes.

3. The flying control tube fork-end fittings, are, at the bolt hole in the lug outer faces, machined with a counterbored recess. This recess is designed to accommodate the nut, on assembly of the control tubes.

4. Should difficulty be experienced when closing and securing the hatch it is recommended that the hatch be secured by first engaging the fasteners nearest to the hinge line and then working across the fuselage to the hatch outer edge.

◀ *5. Ensure bolts, Part No. A25/14E are refitted at the positions noted in para. (7) Note.* ▶

Note...

Whenever the rear fuselage is removed and refitted, a flight trim check (Sect. 3, Chap. 4, App. 1) must be made to ensure that the aircraft trim is within the limits laid down. Should the trim be outside the limits specified, a new elevator trailing-edge strip must be fitted and further flight trim checks, and subsequent trailing-edge strip adjustments, made.

NOTE...

- 1 PORT SIDE OF FRAME SIMILAR TO STARBOARD SIDE
- 2 *ALTERNATIVE STRINGER READING (1) TO (40)
- 3 BOLTS TO BE FITTED WITH HEADS AT THE FRAME FORWARD FACE
- 4 WASHERS TO BE FITTED UNDER THE STIFFNUTS

SYMBOL	ITEM	QUANTITY
A	BOLT, A.25/15G	4
	STIFFNUT, AGS.2001/GI	4
B	BOLT, A.25/7E	16
	STIFFNUT, AGS.2001/EI	16
C	BOLT, A.25/13G	14
	STIFFNUT, AGS.2001/GI	14
D	BOLT, A.25/6E	64
	STIFFNUT, AGS.2001/EI	64
	WASHER, SP.15/E	64
E	BOLT, A.25/13E	40
	STIFFNUT, AGS.2001/EI	40
H	BOLT, A.25/15/E	8
	STIFFNUT, AGS.2001/EI	8
M	BOLT, A.25/10E	6
	STIFFNUT, AGS.2001/EI	6
	WASHER, SP.15/E	6
N	BOLT, A.25/11E	4
	STIFFNUT, AGS.2001/EI	4
	WASHER, SP.15/E	4
P	BOLT, A.25/16M	2
	STIFFNUT, AGS.2001/MI	2
	WASHER, EA1.10.2713	2
	WASHER, SP.15/M	2
S	BOLT, A.25/18M	2
	STIFFNUT, AGS.2001/MI	2
	WASHER, EA1.10.2713	2

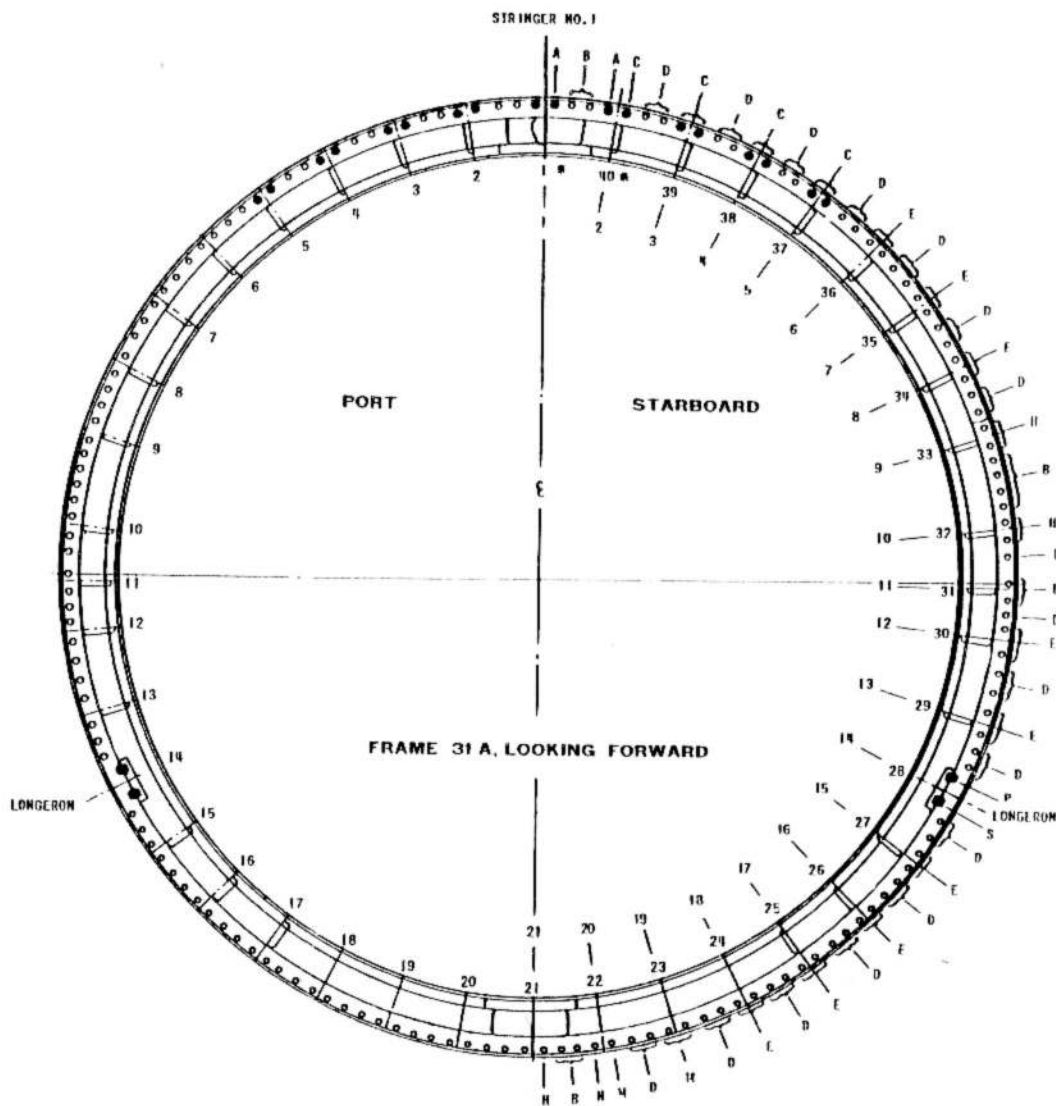


FIG. 17. ATTACHMENT BOLT DETAILS - REAR-TO-CENTRE FUSELAGE

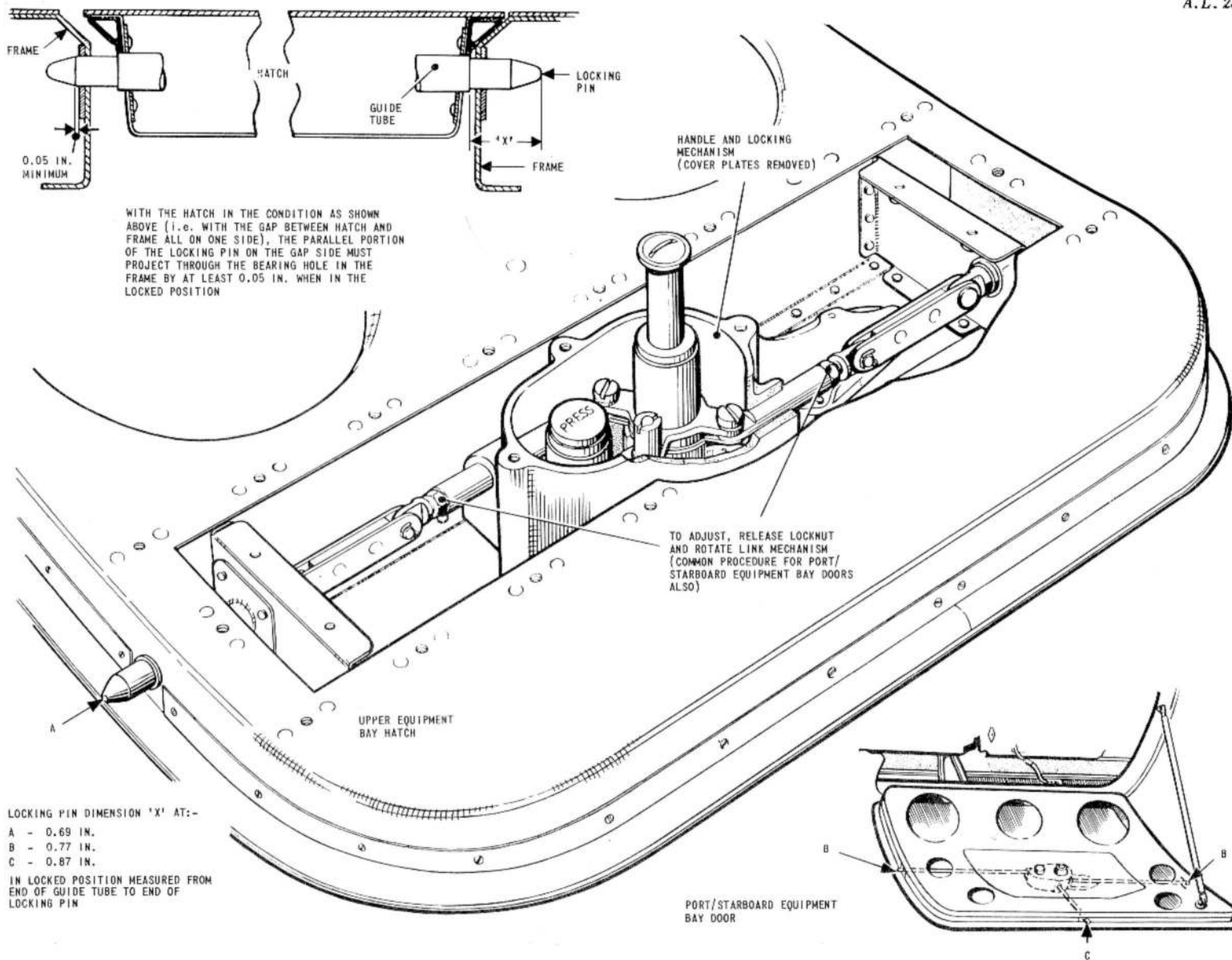


FIG. 18. HATCH LOCKING PIN SETTINGS

Chapter 2 MAIN PLANE

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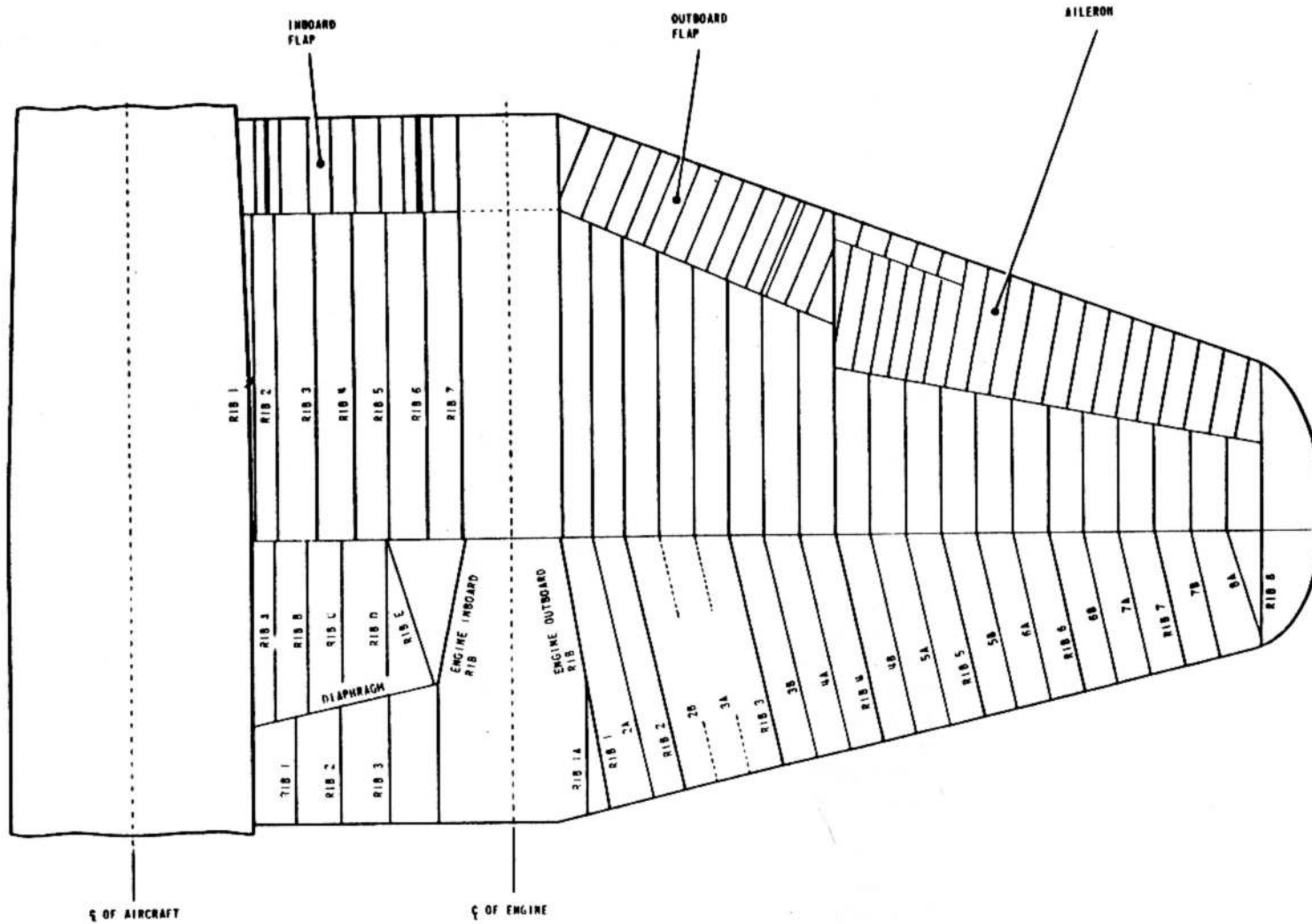


FIG. 1. KEY DIAGRAM

Introduction

1. This chapter gives a general description of the main plane structure and describes pictorially the removal and assembly of certain components. The disposition of the spars and ribs within the structure is illustrated in fig.1.

DESCRIPTION

General information (fig.2)

2. The main plane is a single-spar, cantilever structure with a sectional rear wall, and is built in port and starboard units. There is no conventional centre section, the units being mounted direct on to the sides of the fuselage with the spar continuation through the fuselage maintained by reinforced spar frames. In plan form the main plane units have a parallel-chord centre portion extending to the outboard side of the engine bay, from which point they taper to the wing tip; the leading and trailing edges are straight. The basic structure consists of a torsion box, formed by the spar and rear wall with the rib and stringer system and between-spar skinning. To this is added the inner and outer leading-edge assemblies, the detachable wing tip, the air brake installation and the aileron and flaps, the latter being carried on hinges mounted on the aft face of the rear wall. Static discharge wicks are fitted to the aileron trailing edge and to the wing tip.

Note . . .

The aileron and aileron tab hinges are to be lubricated with grease XG-287. Details of air brakes, flaps and control connection lubrication is given in Chap.4

Spar

3. The spar is a built-up beam extending from the root to the tip; it has a plate web and machined light-alloy booms, the cross-section of which changes from a complex stepped-T at the root, to a plain T at the tip. Lightening holes in the web are reinforced with ring plates, except in the tip portion; there they have integral pressed flanges. To accommodate the engine jet pipe, which passes through the spar, the web is cut off square on each side of the aperture, leaving the booms as continuous members. To the ends of the web so formed are bolted Y-section fittings which form an anchorage for large, forged, light-alloy reinforcing ring-plates bolted to the arms of the Y-section fittings at the front and rear of the spar. At the front of the spar, a rolled, carbon-steel firewall is fitted to the ring-plate forward face.

Spar cooling

4. An air scoop and associated piping distribute cooling air over the spar in the vicinity of the engines. The air scoop protrudes through the top rear engine cowl and is supported on the spar upper forward face. Two diffusers, one above and one below the jet pipe aperture, deliver a supply of cooling air on to the outer side of the heat shroud in the aperture.

Rear wall

5. The rear wall is divided into three sections, an inboard section extending from the root to the jet pipe bay inboard side, a centre section extending from the

jet pipe bay outboard side to the rib at the aileron gap inboard end and an outboard section extending the length of the aileron. The inboard and centre sections are joined by a forged light-alloy I-section ring, through which the jet pipe passes. Each section is built-up of plate webs stiffened by vertical angle-section members and T-section extruded flanges. The web of the outboard section is curved to form the front wall of the aileron pressure-balance box.

Ribs

6. Outboard of the jet pipe bay, the spar and the rear wall are joined by a system of main full-depth ribs, flanked on either side by secondary ribs which, instead of being the full depth of the main plane, are made shallow to allow the span-wise stringers to pass outside their flanges. The main ribs have flat, plate webs with flanged lightening holes and extruded T-section booms. Those secondary ribs in the area bounded by the engine ribs and rib 4 have extruded bulb-angle-section booms; those between rib 4 and rib 8 have plain pressed flanges. Forward of the spar is a similar system of main and secondary ribs which match up those aft of the spar but which are at right angles to the leading edge. Complete nose ribs 2B and 3A port and starboard are not fitted as the turbine-gear alternators are accommodated between ribs 2 and 3. The secondary ribs do not extend as far forward as the main ribs but are cut off some inches short of the leading edge proper. The forward ends of each pair of secondary ribs are joined together and

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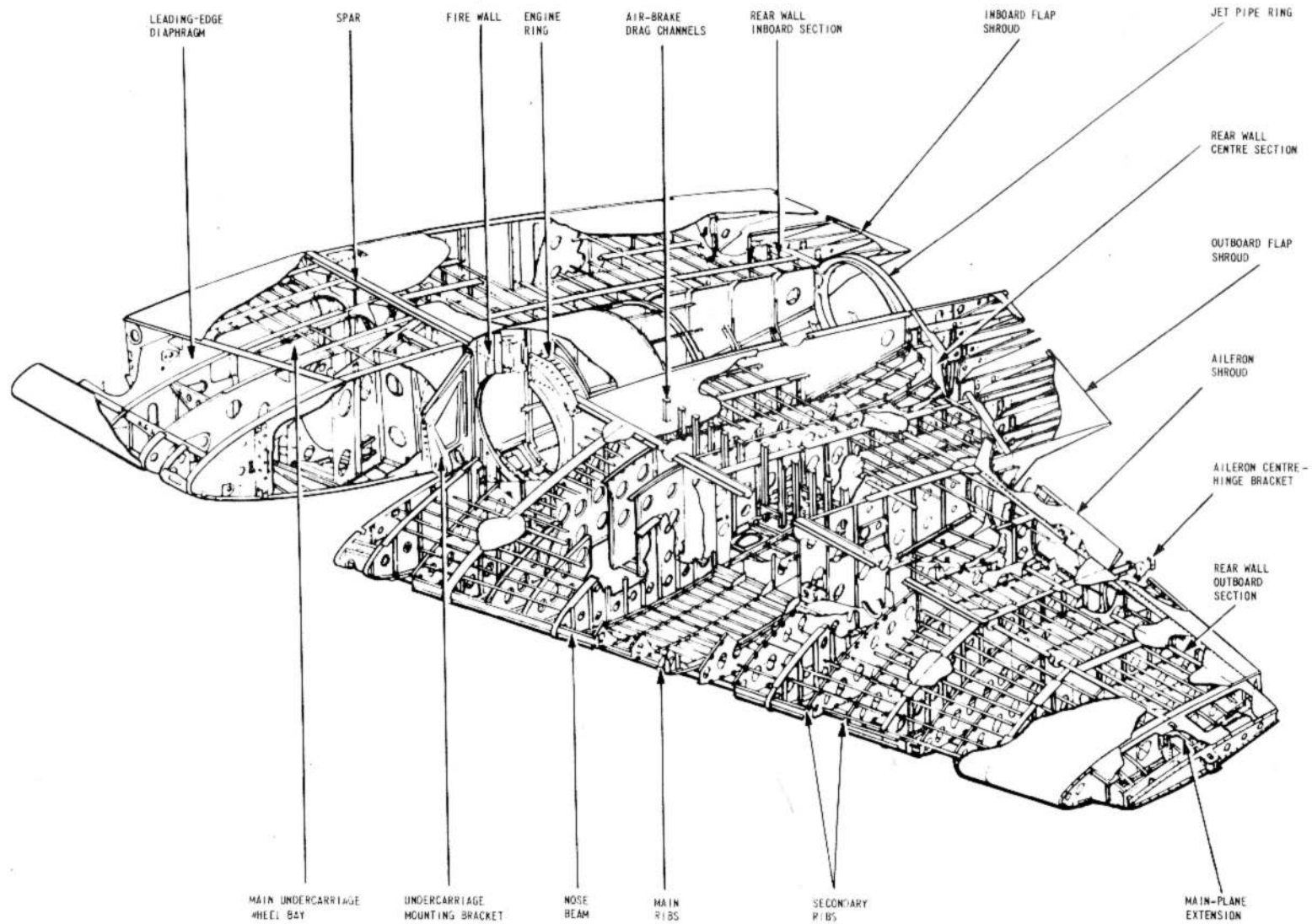


FIG. 2. MAIN PLANE

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to their main ribs by a nose beam passed through the main rib webs. Inboard of the jet pipe bay, the main ribs aft of the spar are similar to those outboard of the bay, but the pressed-flange secondary ribs are of full main-plane depth. Forward of the spar the leading edge houses the main undercarriage unit when retracted; it is divided spanwise by a diaphragm which forms the wheel-bay front wall and extends from the engine bay inboard rib to the fuselage. Forward of the diaphragm, the ribs are constructed of plate webs and angle flanges; aft of the diaphragm the ribs are closed top-hat-section members. On either side of the engine and jet pipe bays special ribs are built up with plate webs and angle-section frames.

Stringers

7. Outboard of the engine and jet pipe bays, the spanwise stringers, of bulb-angle section, lie intercostal with the main ribs but pass outside the secondary ribs. Inboard of these bays the stringers pass through the main and secondary ribs alike.

Skinning

8. The skin plating aft of the spar is in sheets with chordwise butt joints on the centre lines of the main ribs, reinforcing strips being interposed between the rib flanges and the skin. Spanwise joints are made on bulb T-section extrusions running from the outer side of the jet pipe bay to the tip. The leading edge panels are wrapped chordwise round the leading edge.

Wing tips (fig.3)

9. A detachable wing tip is carried on an extension to the main-plane structure at outboard rib 8. The skin covering is attached to a pressed flanged rib and pressed flanged spanwise ribs, the complete assembly being attached to the leading and trailing edges of outboard rib 8, the spar extension rib and the two spanwise ribs of the main-plane extension. A pitot/static pressure head is attached to the leading edge and navigation and taxiing lamps are installed in the nose, where the skin is a moulded transparent plastic sheeting.

Ailerons (fig.3)

10. The ailerons are carried on a centre main hinge and on pin-and-socket hinges at their extremities. The skin covering is attached to pressed ribs which have flanged lightening holes. The ribs are flanged on their lower edge and have a separate angle-section extruded flange on the upper edge. The aileron spar, to which the ribs are attached, has a plate web with flanged lightening holes and carries the D-shaped nose ribs and beaks. Aileron shroud plates, which may be opened to facilitate servicing of the aileron-operating mechanism, are mounted on piano-type hinges on the main-plane rear wall. Mass balance of the surface is effected by heavy-alloy strips riveted between the beak ribs. To accommodate the spring tab, the aileron trailing edge between its inboard end and rib 7 is cut away, and the ribs between these points are shortened and carry a curved rear web which forms the spring tab pressure-balance box front wall.

Aileron spring tabs (fig.3)

11. The aileron spring tabs are hinged to the aileron by a main centre hinge and pin-and-socket hinges at their extremities. The skin covering is attached to pressed flanged ribs and the tubular spar. The spar is reinforced at the centre hinge point by an inner tube and each end of the spar houses a socket in which the hinge pin is secured. Extensions to the upper and lower skins forward of, and riveted to, the spar, form a beak in which triangular wood alignment blocks are inserted at intervals. At the apex of the beak the upper and lower skins are continued forward to form a flat plate extension, terminating in a 60 degree extrusion.

Flaps (fig.3)

12. The split trailing-edge flaps are single-spar structures of triangular cross section, carried on pin-and-socket hinges. Pressed, flanged nose, and trailing edge ribs are attached to the spar, the whole structure being covered with a light-alloy skin riveted to the spar and ribs. Flanged lightening holes are cut in the upper skin surfaces.

Air brakes (fig.10)

13. The hydraulically-operated air brakes consist of 21 drag channels housed inside each main plane, aft of the main spar. In the out position, nine of the channels protrude through the upper skin surface and twelve through the lower surface; in the in position the ends of all drag channels lie flush with the skin surfaces. The

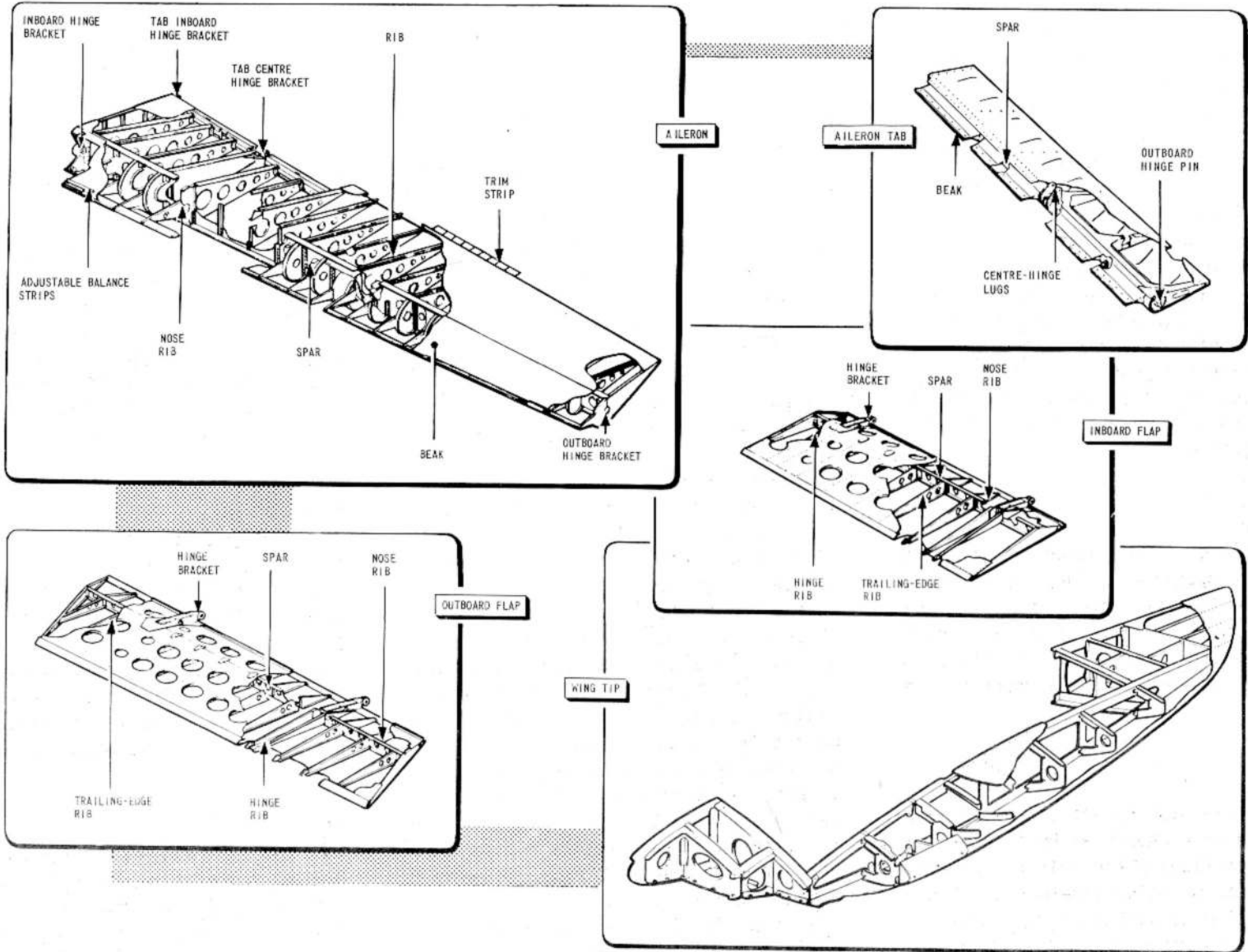


FIG. 3. MAIN-PLANE COMPONENT PARTS

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drag channels are attached to the ends of centrally-pivoted rocker arm assemblies, which are attached to a spanwise torque tube constructed in three portions and connected together at outboard ribs 3A and 3B; the tube is carried in bearings at its centre and ends. Annular plates attached to the webs of outboard ribs 2 and 4 accommodate the end bearings; the centre bearing, at rib 3, consists of three rollers, one of which is adjustable to facilitate removal and assembly of the torque tube. A lever in the centre and integral with a rocker arm assembly, is connected to the hydraulic operating jack mounted on the rear of the main spar.

Vortex generators

14. Eight vortex generators are fitted to the underside of the main spar, inboard of rib 8. The purpose of these generators is to compare the flying characteristics, but to derive any benefit, it is necessary that the wing-tip pods (Sect.5, Chap.5) and the tanks (Sect.4, Chap.2) are also fitted with vortex generators.

Turbine-gearred alternators

15. A turbine-gearred alternator (Sect.4, Chap.1) is fitted in each main plane between nose ribs 2 and 3 forward of the main spar. Two access panels to accommodate the alternator slings, and one panel to provide access to the oil filler and dipstick, are located in each main plane upper surface. A panel in the lower-surface leading edge provides access to the frequency control. A panel of double skin structure with internal Z members, situated in each main plane lower surface, gives access to the alternator installation. An orifice formed within the centre portion of each panel

houses a ram-air duct which directs cooling air to the alternator. Air-outlet ducts are located at the rear of the panel.

REMOVAL AND ASSEMBLY

Note . . .

After the removal and reassembly of any component which may affect the longitudinal trim of the aircraft, carry out flight trim checks in accordance with Sect.3, Chap.4, Appendix 1.

General Information

16. The following paragraphs contain information on the removal and assembly of the main plane and its principal components. Only the removal operations are given in detail as the assembly is generally a reversal of this procedure; where this is not so, the difference is noted. The necessary ground equipment is listed in Sect.2, Chap.4.

Main plane sling (fig.4)

17. The main plane sling, which can only be used when the engine and jet-pipe are removed, is a triangular tubular frame, which is attached to the main plane by the beam at the engine rear mounting bracket (detail B), by a hook at the rear wall connecting ring, and by a picketing/slinging ring bolt fitted at the slinging point in the upper surface of the main plane (Sect.2, Chap.4). It is designed to sling both the port and the starboard main planes and its preparation procedure is detailed in fig.4. Three rings, for attachment to the crane-hook shackle, are provided in the slinging cables and are used in either one of two conditions, depending on which components are fitted to the main plane during the lifting operation. Both conditions are given in fig.4.

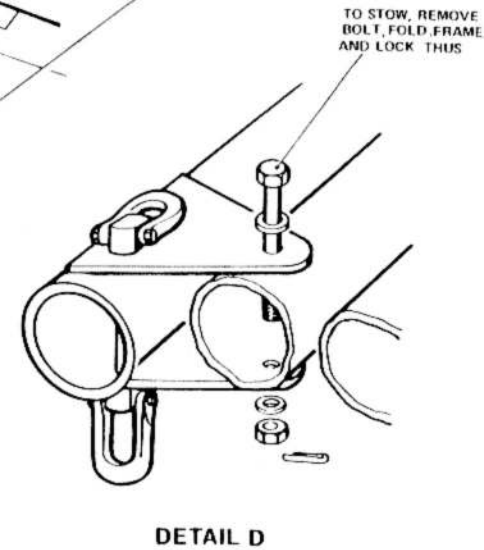
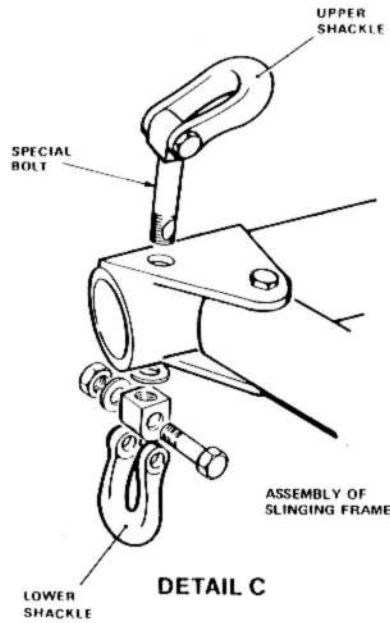
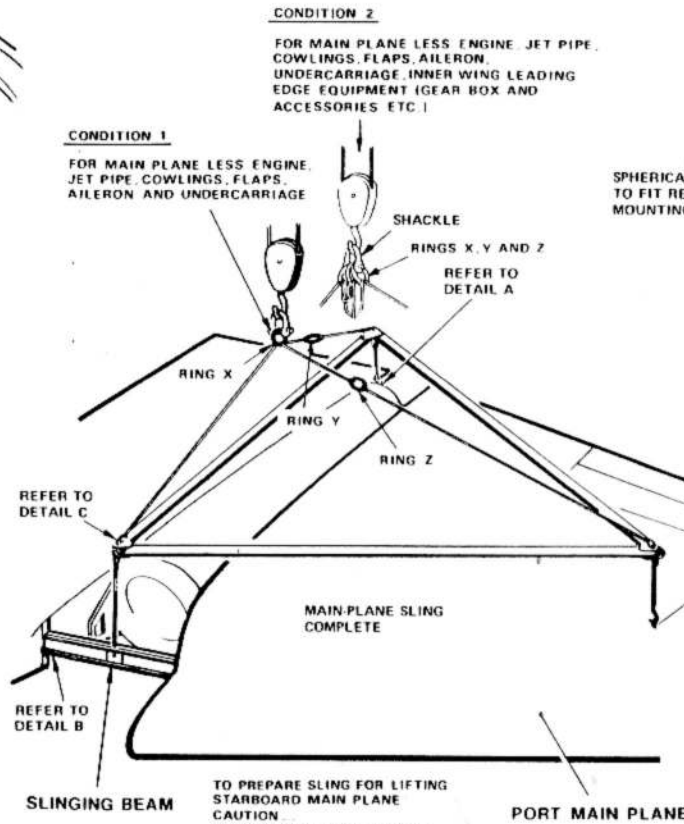
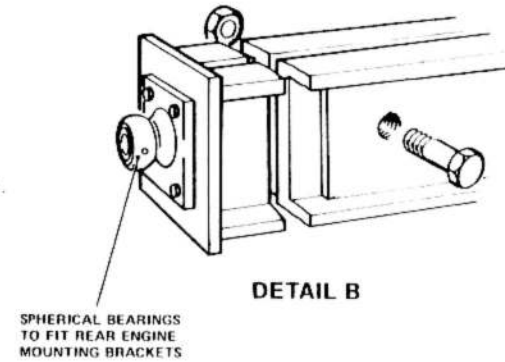
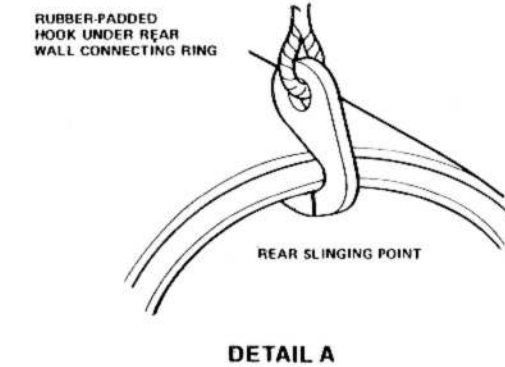
Note . . .

1. *Wing-tip tank fuel must be drained and the wing-tip removed (Sect.4, Chap.2) before a main plane is slung.*
2. *During main plane removal, and more particularly during assembly, great care must be taken to prevent any damage to the upper and lower main spar skin attachment flanges. These flanges if subjected to excessive loads, are liable to crack and this condition may occur if fouling of the flanges with the main plane attachment lugs takes place. It is therefore essential that the main plane is balanced in the correct attitude, relative to the fuselage, before it is offered up. Although the main plane sling will balance it in approximately the correct position it is imperative that final adjustments are made by ballasting.*
3. *It is recommended that, whenever possible, the flaps and ailerons are removed for main plane removal and replacement.*

18. To attach the sling to a main plane:-

- (1) Remove the caps from both the engine rear mounting brackets.
- (2) Place the slinging beam across the engine bay with the spherical ends of the beam resting in the lower halves of the engine mounting brackets. Refit the caps on the engine mounting brackets.
- (3) Insert the eyebolt in the main-plane upper surface slinging point.
- (4) Assemble the slinging frame to suit the main plane being lifted and attach the sling to the hoist by the slinging eye, or eyes (para.17).
- (5) Adjust the hoist until the cable at the forward apex of the frame can be attached to the centre of the slinging beam, pass the hook on the cable at the rear apex of the frame under the

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TO PREPARE SLING FOR LIFTING STARBOARD MAIN PLANE
CAUTION
THE FOLLOWING PROCEDURE MUST BE ADHERED TO OTHERWISE DAMAGE TO THE SPECIAL BOLTS WILL RESULT
REMOVE LOWER SHACKLES AT EACH CORNER OF FRAME, WITHDRAW SPECIAL BOLTS WITH UPPER SHACKLES ATTACHED, AND TURN FRAME OVER. REFIT SPECIAL BOLTS AND SHACKLES WITH BOLT HEADS UPPERMOST. REFIT THE LOWER SHACKLES

FOR STOWAGE OF SLING REFER TO DETAIL D

FIG.4. MAIN PLANE SLINGING

◀ NEW ILLUSTRATION ▶

rear wall connecting ring, and the hook on the cable at the outboard apex of the frame through the slinging eye in the main plane.

Main plane

19. Refer to the key to fig.6.

◀ Aileron (fig.7)

Removal

20.

CAUTION

Ailerons must not be removed or refitted while wing tip fuel tanks are fitted to the aircraft.

To remove an aileron with or without the spring tab fitted proceed as follows:—

- (1) Open all aileron shrouds by removing the countersunk screws at the extremities of each shroud.
- (2) Disconnect the aileron control rod from the lever arm.
- (3) Remove the access panel from the underside of the wing tip.
- (4) Remove the four 0.25 in. dia. bolts attaching the centre hinge bracket to the aileron and note the number of shims. To facilitate the removal of these bolts, the centre shroud attachment brackets may be removed.

Note . . .

In the event of the centre hinge shroud attachment brackets being removed, note the number and position of shims. During reassembly, check the shroud and attachment bracket bolt holes for alignment and fit shims as necessary to ensure that no gap exists between the aileron centre hinge and shroud attachment brackets.

◀(5) Lower the flaps, support the aileron at its extremities, remove the nut and bolt from the inboard hinge pin, and using the extractor, (Sect.2, Chap.4 Table 1) withdraw the hinge pin.

(6) Remove the split pin from the outboard hinge pin and using the extractor, withdraw the hinge pin.

(7) Remove the aileron.

Assembly

Note . . .

If the aileron centre hinge bracket to mainplane rear wall attachments are disturbed, check alignment of bracket using tool ST8/25533 and adjust shimming as required.

21. Reassembly of the existing aileron to the main plane is a reversal of the removal procedure plus checking the clearances (Fig.5), but if a new aileron is being fitted, before fitting it, check the alignment of the centre hinge bearing and if necessary adjust as follows:— ▶

(1) Offer up the aileron to the main plane and engage the inboard and outboard hinge pins.

(2) Check the clearance between the aileron hinge bracket and the forward face of the aileron spar.

(3) Remove the aileron and attach a shim Part No.EA1-24-901 (supplied with a new aileron), of the thickness required at operation (2), to the forward face of the aileron spar, using the hinge-bracket attachment screws; a maximum of two shims (0.10 in.) may be fitted.

(4) With the end holes of the shim as guides, mark out and drill two holes 0.0785 in. dia. (drill No.47), in the aileron spar and secure the assembly with P.K. screws (Part No.2R3/16 in. S.971).

(5) Remove the attachment screws used at operation (3).

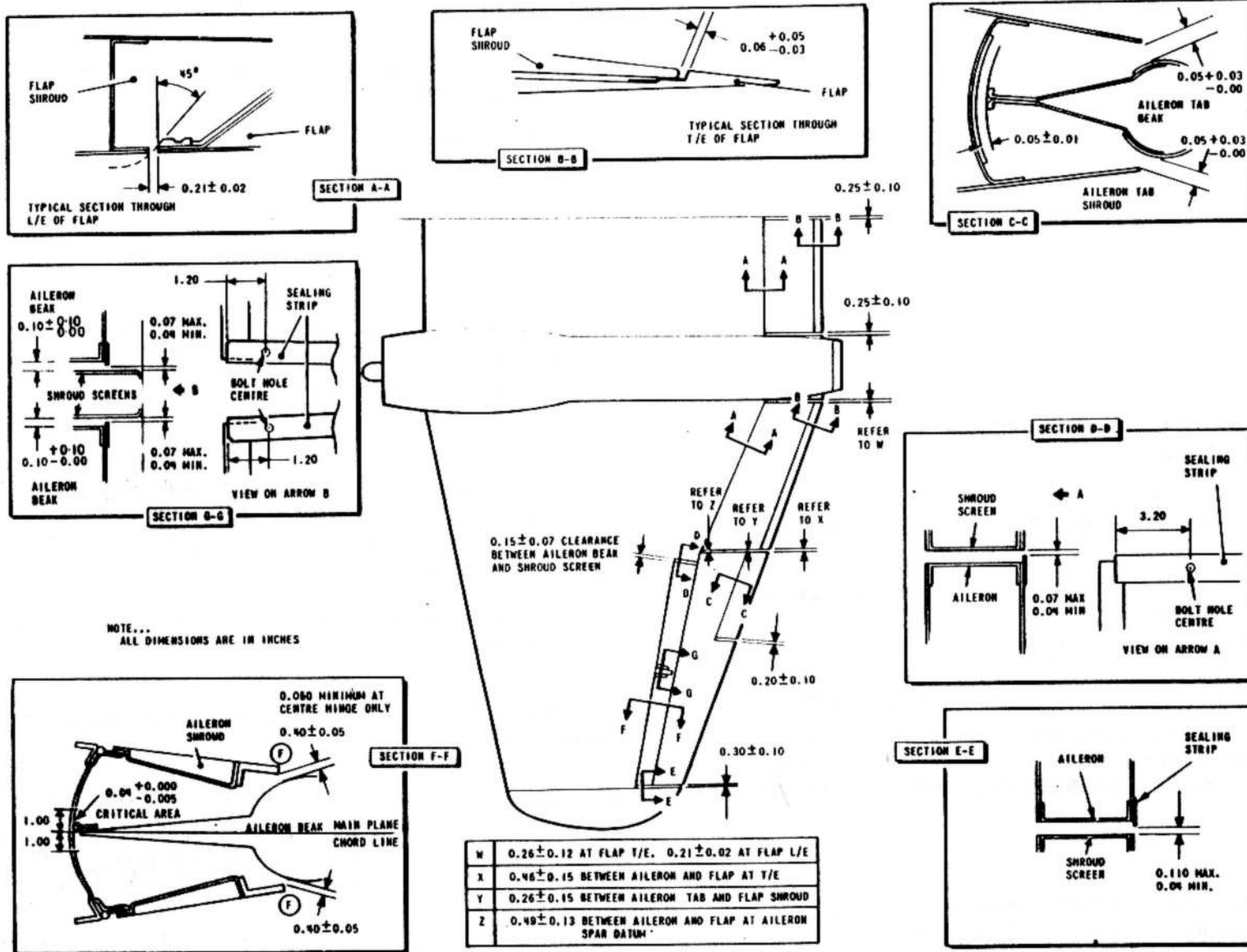


FIG.5. MAIN-PLANE CLEARANCES

22. After fitting a new aileron, check for clearances (*fig.5*) and, if necessary, make the following adjustments:—

(1) To obtain the correct clearance between the aileron beak and the main plane rear wall in the critical area one inch either side of the main plane chord line (*Section F-F*), it is permissible to have a clearance of 0.015 in. min. to 0.10 in. max. between the beak and wall over the remainder of the travel. Should the aileron beak foul the fabric over the shroud hinges, trim the fabric locally to clear.

(2) To obtain the correct clearance between the two aileron shroud screens and the aileron beak at the centre hinge (*Section G-G*):—

(a) Open the aileron upper shrouds and remove the sealing strips from the aileron beak. The lower shrouds support the screens and are to be opened only as necessary to obtain the required clearance between the aileron shroud screens and aileron beak.

◀ (b) Sandwich the clearance gauge (*fig.12*) between either of the screens and the beak; hold it in position by applying hand-pressure to the screen and gently close the corresponding upper and lower shrouds. Check that the pegs on the screen enter the holes in the shrouds, if they do not remove the clearance gauge and carry out a repair in accordance with A.P.101B-0400-6, Part 2.

(c) Remove the clearance gauge and repeat operations (a) and (b) on the other screen.

(d) Reopen the upper shroud at either of the screens. Using the clearance gauge, check that the correct clearance between the beak and screen is maintained and secure the screen in position using the appropriate centre screen locating jig (*fig.12*) by locating the two upper pegs of the screen in the corresponding holes in the jig and bolting the aft end of the jig to the shroud angle attachment bracket. Remove the clearance gauge. ▶

(e) Assemble the sealing strip to the aileron beak, unlock the ailerons and obtain the correct clearance over the full range of aileron movement.

(f) Remove the locating jig and close the aileron shroud.

(g) Repeat operations (a), (b), (c), (d), (e) and (f) at the other screen.

(3) To obtain the correct clearance between the aileron inboard shroud screen and the aileron beak (*Section D-D*):—

(a) Open the aileron upper inboard shroud, and remove the sealing strip from the aileron beak inboard edge.

◀ (b) Position the inboard screen locating jig stamped (*fig.12*), on top of the screen by mating the screen peg with the jig and the point of the jig pointing aft. Mark off and drill a hole in the screen flange using the end hole in the locating jig as a template and bolt the two items together at this position. ▶

(c) Close the shroud so that the screen takes on its normal position and, using a pencil, mark the position of the aft point of the locating jig on to the aileron. Reopen the shroud.

(d) Align the aft point of the locating jig with the pencilled mark on the aileron and, while held in this position, bolt the second (moveable) leg of the jig to the shroud angle attachment bracket.

(e) Using a feeler gauge, measure the clearance between the screen and aileron, this should be 0.15 in. \pm 0.07 in.; if the clearance is incorrect, carry out a repair in accordance with A.P. 101B-0400-6, Part 2.

(f) Assemble the sealing strip to the aileron beak, unlock the ailerons and obtain the correct clearance over the full range of aileron movement.

(g) Remove the locating jig.

(4) To obtain the correct clearance between the aileron outboard shroud screen and the aileron beak (*Section E-E*):—

(a) Slacken the sealing strip attachment screws and adjust the strip.

(b) Tighten the attachment screws after adjustment.

(5) Check the alignment of the aileron shrouds (*Section F-F*); they must be in true alignment with the main plane and aileron contours ▶ \pm 0.0312 in. measured along the upper and lower surfaces at the trailing edges of the shrouds at F. Adjust their alignment by the shims on the aileron shroud angle brackets at ribs 4, 6 and 8. ▶

(6) If there is not sufficient clearance between the aileron shrouds and the aileron (*Section F-F*), file the edges of the shroud, leaving a minimum of 0.025 in. between the rivet heads and the edge of the shroud; do not adjust this clearance by reshimming the aileron shrouds. Apply protective treatment (*A.P.119A-0509-1*) to filed surfaces.

◀ Note . . .

After assembly of the aileron to the main plane, flight trim checks as specified in Sect.3, Chap.4, App.1 must be carried out. Should the aircraft trim be outside the limits specified, a new elevator trailing-edge strip should be fitted and the flight trim-checks and subsequent trailing-edge strip adjustments carried out.

Aileron spring tab (fig.7)*Removal*

23. To remove an aileron spring tab proceed as follows:—

- (1) At the centre hinge remove the two countersunk screws attaching the control rod fairing to the aileron and remove the fairing.
- (2) Remove the four 2 B.A. bolts and the two countersunk screws attaching the centre hinge bracket to the tab.
- (3) Remove the locking wire from the inboard hinge pin and, with the tab adequately supported, remove the hinge pin.
- (4) Remove the tab from its outboard hinge pin by drawing the tab inboard.

Assembly

24. Reassembly of the existing aileron spring tab to the aileron is a reversal of the removal procedure plus checking the clearances (fig.5) but if a new tab is being fitted, after its fitment, check for correct clearance and if necessary make the following adjustments:—

- (1) If the clearance between the tab beak and the rear web of the aileron (Section C-C) is incorrect, it may be adjusted by filing the tab beak.
- (2) If the clearance between the tab shrouds and the tab (Section C-C) is incorrect it may be adjusted by filing the edges of the shrouds.
- (3) Apply protective treatment (A.P.119A-0509-1) to filed surfaces. ▶

◀ Note . . .

1. Whenever an aileron or aileron tab is removed and replaced or adjusted, a flight trim check must be made in accordance with Sect.3, Chap.4, App.1, to ensure that the aircraft trim is within the specified limits. Should the aircraft trim be outside the specified limits, a new elevator trailing-edge strip must be fitted and the flight trim checks and subsequent trailing-edge strip adjustments made.

2. When refitting bolts and screws removed in para.23(2), check for adequate locking. If locking is unsatisfactory, remove bolts and screws and fit shake-proof washers AGS.2035/C to the 2 B.A. hexagon bolts, or AGS.2036/C to the 2 B.A. countersunk screws. If AGS.2036/C has been used, check clearance at edge of fairing and head of countersunk screws.

Aileron tab operating gear

25. Refer to Sect.3, Chap.4. ▶

Flaps

26. Refer to fig.8.

27. After fitting a new flap, check for correct clearances (fig.5) and if necessary, make the following adjustments:—

- (1) If the clearance between the flap leading edge and the main plane (Section A-A) is insufficient, file the flap leading edge (maintaining the 45 deg chamfer).
- (2) Apply protective treatment (A.P.119A-0509-1) to filed surfaces.

Flap jack (fig.9)*Removal*

28. With the flaps in the fully-down position:—

- (1) Exhaust the system of hydraulic pressure (Chap.6).
- (2) Disconnect the two hydraulic pipes from the jack, and blank off the pipe-lines and the jack connections (3).

(3) Remove the split pin and washer from the connecting pin securing the jack connecting rod to the flap mechanism and remove the connecting pins (1).

(4) Remove the six 2 B.A. bolts and nuts securing each of the two cover plates to the ribs adjacent to the jack body, and remove the plates (2).

(5) Remove the two 3/8 in. B.S.F. nuts and bolts securing the flanged end of the jack to the mounting bracket and the two 5/16 in. bolts securing the ring mounting to the bracket at the opposite end (4).

(6) Remove the jack from the main plane.

Assembly

29. Assembly of the flap jack is the reverse of para.28, plus the following operations:-

(1) Ensure that the washers fitted to the mounting bolts at the flanged end of the jack are correctly positioned (fig.9).

(2) Adjust the jack connecting rod fork ends as necessary to enable the connecting pins (1) to connect with the flap mechanism push-rods (the fork-end at the flanged end of the jack first). After making this adjustment, check the dimension between the pin centre and the nearest face of the cylinder flange; this must be 3.13 in. \pm 0.25 in. When final adjustment of the opposite fork-end is completed, check the dimension

between the jack pin centres; this must be 18.30 in. \pm 0.25 in. For checking purposes, jack travel is 3.90 in. \pm 0.015 in. After adjustment, wire-lock both fork-ends, spanner grips and lock-nuts.

(3) Bleed the jack and pipelines, and test the functioning of the flaps (Chap.6).

Air brakes

30. Refer to the key to fig.10. After assembling the air brakes into the main plane set the mechanism as described in Chap.4.

Air brakes hydraulic jack

31. When a replacement air brakes hydraulic jack is fitted, the standard locknut and tab washer must be removed from the jack piston rod, and replaced by a special-to-type locknut Ref.No. 26FZ/1642 and tab washer Ref.No.26FZ/1641. Wire-lock the banjo bolt to the jack body.

Wing tips (fig.11)

Removal

32.

(1) Remove the wing-tip pod (Sect.5, Chap.5), or wing-tip fuel tank (Sect.4, Chap.2) if fitted.

(2) Remove the access panel in the wing-tip bottom skin.

(3) Disconnect the electrical cables from the terminal block in the leading edge.

(4) Remove the rubber seal (port side only) from around the pitot boom at the wing-tip perspex window, and remove the countersunk screws securing the window to the wing tip. Remove the window.

(5) Remove the bolts securing the wing tip to rib 8 trailing edge.

(6) Remove the countersunk screws securing the wing tip to the main plane extension.

(7) Remove the wing tip.

Pitot boom (fig.11)

Removal

33.

(1) Remove the access panel from the port main plane extension lower surface.

(2) Remove the perspex window and rubber seal from the wing tip (para.32).

(3) Disconnect the pressure head electrical leads from the terminal block at rib 8.

(4) Disconnect the pitot and static pipes at the rear of the pressure head. Blank off the pipe ends.

(5) Remove the 2 B.A. nut, bolt, and washer securing the pitot boom to the rear mounting bracket at rib 8. Slacken the four 1/4 in. B.S.F. bolts at the front and rear mounting brackets and withdraw the boom from the main plane.

KEY TO FIG. 6 (MAIN PLANE - REMOVAL AND ASSEMBLY)

- (1) Remove the wing-tip pod (Sect.5, Chap.5) or wing-tip fuel tank (Sect.4, Chap.2) if fitted.
- (2) Remove the turbine-gearred alternator (Sect.4, Chap.1).
- (3) Remove the engine and jet pipe (Sect.4, Chap.1).
- (4) Jack and trestle the aircraft (Sect.2, Chap.4), and attach the sling to the main plane (para.18). Take the weight of the main plane on the sling.
- (5) Remove the main undercarriage door and undercarriage unit (Sect.3, Chap.5).
- (6) Remove the access panels, (18), (26), (35) and (42).
- (7) Remove the closing strips, (19) and (29).
- (8) Remove the screws securing the leading-edge skin to the fuselage attachment angle landing (49) and (50).
- (9) Disconnect the fuselage/main plane connections of the following controls and services:
- (a) Engine control rods, (51) from (57).
- (b) Hydraulic pipes, main pressure and return, (52) from (58).
- (c) Air conditioning system transverse duct, (48) from (56).
- (d) Electrical cable from Type X3 suppressor (P3 generator system only), (54).
- (e) Cabin-air delivery pipe, (47) from (59) (port side only).
- (f) Electrical cables C7 and C7X, (44) and (45) from J.B.7 (J.B.8 starboard main plane).
- (g) Fuel delivery pipe, (46) from (60).
- (h) Fire protection pipe, (2).
- (i) Hydraulic pipes, (5) from (37).
- (j) Air conditioning system duct, primary cooler to mixing valve, (41).
- (k) Hydraulic pipe, (7) from (38).
- (l) Aileron control rod, (8) from (36).
- (m) Electrical cable (P9), (9) from (39) (port side). Electrical cable (S10), (9) from (39) (starboard side.)
- (n) Green Satin aerial (LB/B), (10) from (40) (port side only).
- (o) Radio compass aerial, (11) (port side). Glide path aerial, (11) (starboard side).
- (p) Wing-tip fuel tank air pipes, (12) from (34).
- (q) Hydraulic pipes from air brakes, (13) from (32).
- (r) Pitot/static pipes, (14) from (33) (port side only).
- (s) Electrical cable (P455), (15).
- (t) Electrical cable (P450), (16) from (30).
- (u) Electrical cable (P456), (17) from (31).
- (v) Wing-tip fuel-transfer pipe, (21) from (28).
- (w) Green Satin waveguide, (23) (port side only).
- (x) Flaps Desynn transmitter electrical cable, (25).
- (y) Flaps hydraulic pipes, (24) from (27).
- (z) *deleted*
- (10) Remove the split pin, nut and washer (4) from the bolt (53) at the forward attachment point (55). Retain any packings and withdraw the bolt.
- (11) Remove the locking collar (22)

KEY TO FIG.6 (MAIN PLANE - REMOVAL AND ASSEMBLY) - *continued*

from the rear attachment bolt (20) and withdraw the bolt.

(12) Remove the split pins, nuts and washers from the seven shear bolts (6) and withdraw the bolts.

(13) Remove the split pins, nuts and washers from the two upper main attachment bolts (4), and the split pins, nuts, pads and washers from the two lower attachment bolts (3). Remove the four bolts using extractor Ref. No. 26FZ/95047. The main plane is now free, lift it clear and place on trestles (*Sect.2, Chap.4*).

Assembly notes . . .

1. Before assembling the main plane to the fuselage, ensure that the sealing blocks Ref. EA1-20-2897 (upper) and EA3-20-135 (lower) are securely attached with rubber-resin cement Ref. No. 33H/2245977, within the forks of the centre section spar fitting, as shown in the detail. Ensure that ST1/Can/498A has been carried out.

2. Before fitting the spar lower attachment bolts (3), lubricate the bolt threads and nut faces, fit them and tighten the nuts alternately by applying a torque loading of 1500 lbf in.

3. After assembling the main plane to the fuselage, and before fitting the shear bolts (6), attach with rubber-resin cement, a sealing block Ref. No. 26FZ/384. The block must be hard up to the forward face of the spar lower boom and the fuselage side, as shown in the detail.

4. At the forward attachment point (2) the attachment bolt (53) is a ½ in. dia. B.S.F. (A59/11N). It is to be torque tightened to 100 lbf in.

◀ Note . . .

This bolt must be removed, discarded and replaced with a new bolt at each subsequent minor star servicing (ST1/CAN/605B). ▶

5. When securing the main-plane skin to the fuselage attachment angle landing, the sixty-eight 2 B.A. screws securing the leading-edge skin, from the main spar on the upper surface to the forward edge of the main undercarriage bay, must be fully tightened and then slackened off one quarter of a turn; this ensures freedom of movement between the wing and the fuselage.

6. When fitting a new main plane refer to A.P.101B-0400-6, Part 1.

Note . . .

A flight trim check must be made in accordance with Sect.3, Chap.4, Appendix 1, whenever a main plane is removed and refitted or renewed, to ensure that the aircraft trim is within the limits laid down. Should the aircraft trim be outside the limits specified, a new elevator trailing-edge strip must be fitted and the flight trim checks and subsequent trailing-edge strip adjustments carried out.

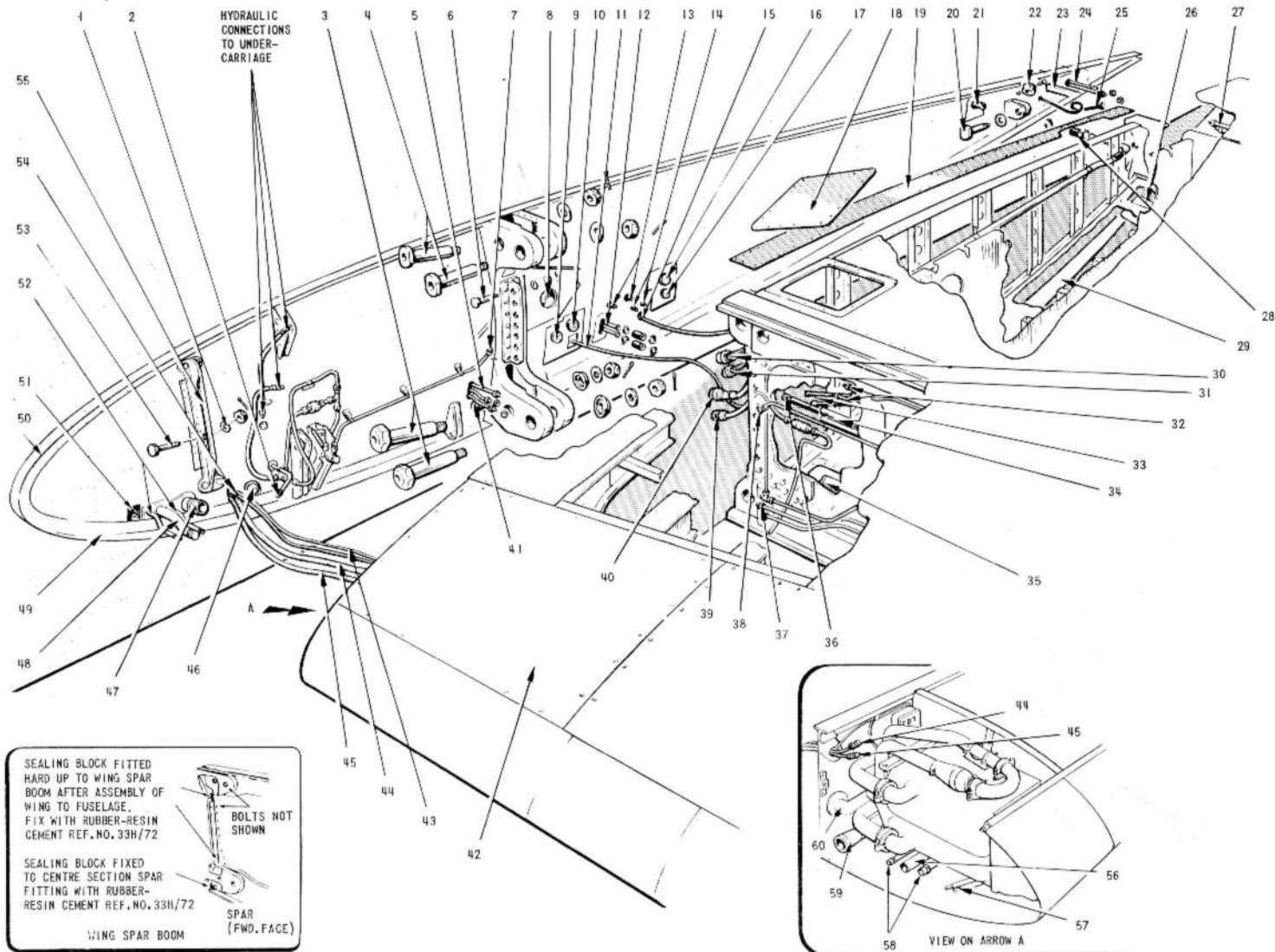


FIG. 6. MAIN PLANE - REMOVAL AND ASSEMBLY

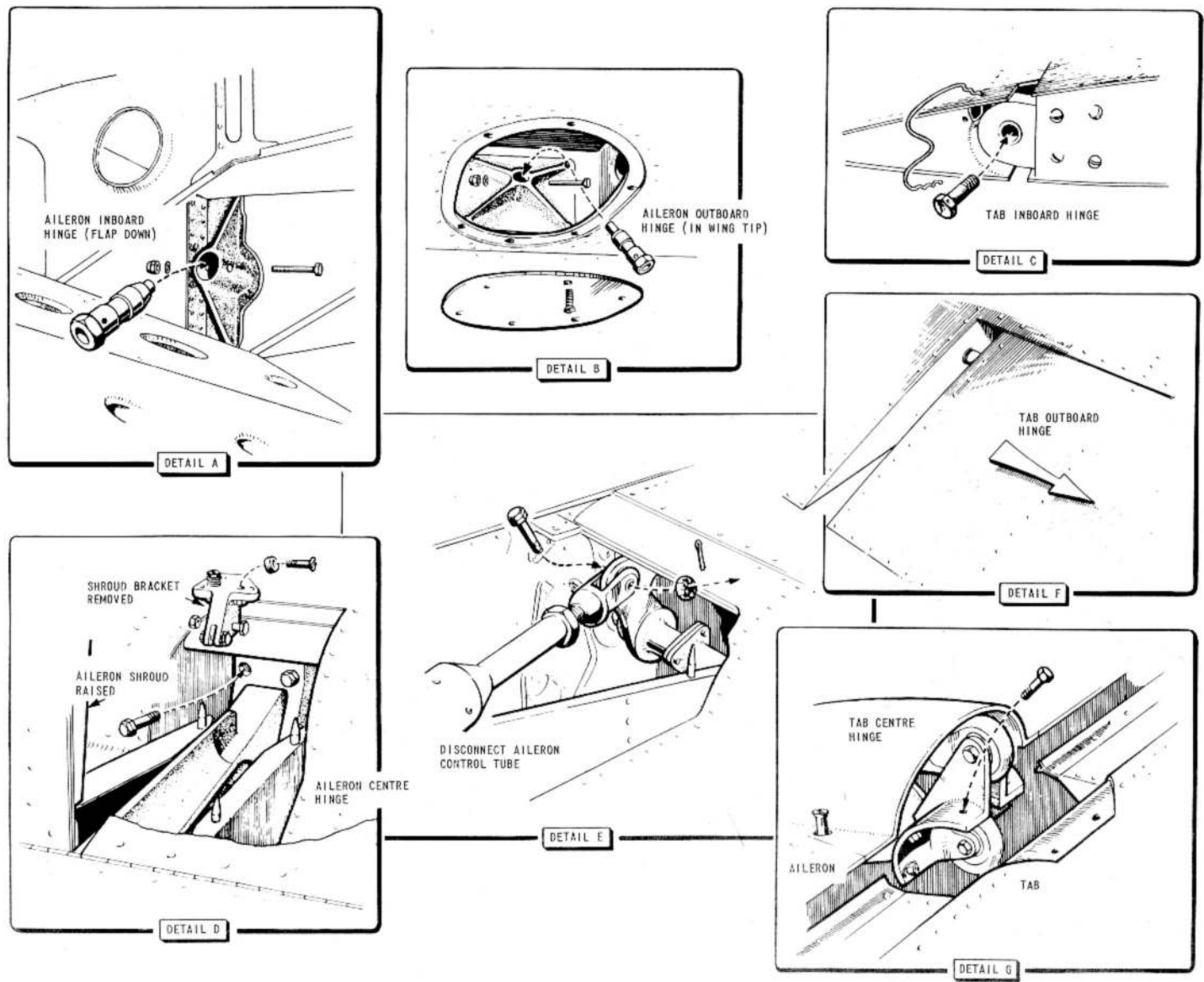


FIG. 7. AILERON AND AILERON TAB-REMOVAL AND ASSEMBLY

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◀ **Main plane (fig.6)****Removal**

34. To remove a main plane proceed as follows:-

- (1) Remove the wing-tip pod (Sect.5, Chap.5) or wing-tip fuel tank (Sect.4, Chap.2) if fitted.
- (2) Remove the turbine - geared alternator (Sect.4, Chap.1).
- (3) Remove the engine and jet pipe (Sect.4, Chap.1).
- (4) Jack and trestle the aircraft (Sect.2 Chap.4), and attach the sling to the main plane (para 18). Take the weight of the main plane on the sling.
- (5) Remove the main undercarriage door and undercarriage unit (Sect.3, Chap.5)
- (6) Remove the access panels, (18), (26), (35) and (42).
- (7) Remove the closing strips, (19) and (29).
- (8) Remove the screws securing the leading-edge skin to the fuselage attachment angle landing (49) and (50).
- (9) Disconnect the fuselage/main plane connections of the following controls and services:-
 - (a) Engine control push-pull rods (51) from (57).
 - (b) Hydraulic pipes, main pressure and return (52) from (58).
 - (c) Air conditioning system transverse duct (48) from (56).
 - (d) Electrical cable from Type X3 suppressor (54) (P3 generator system only).
 - (e) Cabin-air delivery pipe (47) from (59) (port side only).
 - (f) Electrical cables C7 and C7X (44) and (45) from J.B.7 (J.B.8 on starboard main plane).
 - (g) Fuel delivery pipe (46) from (60).
 - (h) Fire protection pipe (2).
 - (j) Hydraulic pipes (5) from (37).
 - (k) Air conditioning system duct, primary cooler to mixing valve (41).
 - (l) Hydraulic pipe (7) from (38).
 - (m) Aileron control rod (8) from (36).
 - (n) Electrical cable P9 (9) from (39) (port side). Electrical cable S10(9) from (39) (starboard side).
 - (o) Green Satin aerial LB/B (10) from (40) (port side only).
 - (p) Radio compass aerial (11) (port side). Glide path aerial (11) (starboard side).
 - (q) Wing-tip fuel tank air pipes (12) from (34).
 - (r) Hydraulic pipes from air brakes (13) from (32).
 - (s) Pitot/static pipes (14) from (33) (port side only).
 - (t) Electrical cable P455 (15).
 - (u) Electrical cable P450 (16) from (30).
 - (v) Electrical cable P456 (17) from (31).
 - (w) Wing-tip fuel-transfer pipe (21) from (28).
 - (x) Green Satin waveguide (23) (port side only).

◀ (y) Flaps Desynn transmitter electrical cable (25).

(z) Flaps hydraulic pipes (24) from (27).

(10) Remove the split pin, nut and washer (1) from the bolt (53) at the forward attachment point (55). Retain any packings and withdraw the bolt.

(11) Remove the locking collar (22) from the rear attachment bolt (20) and withdraw the bolt.

(12) Remove the split pins, nuts and washers from the seven shear bolts (6) and withdraw the bolts.

(13) Remove the split pins, nuts and washers from the two upper main attachment bolts (4) and the split pins, nuts, pads and washers from the two lower attachment bolts (3). Remove the four bolts using an extractor (Sect.2, Chap.4, Table 1). The main plane is then free and should be lifted clear and placed on trestles (Sect.2 Chap.4).

Assembly

35. Assembly of the main plane to the fuselage is a reversal of the removal procedure with the following additional operations included:-

(1) Before assembling the main plane to the fuselage, ensure that the sealing blocks Part No EA1 20.2897 (upper) and EA3.20.135 (lower) are securely attached with rubber resin cement Ref. No. 33H/2245977 within the forks of the centre section spar fitting, as shown in the detail of Fig.6. Ensure that S.T.I./Can./498A has been satisfied.

(2) Before fitting the spar lower attachment bolts, lubricate the bolt threads and the nut faces with grease XG-287 and, when tightening the nuts, apply a torque of 1500 lbf in., using a suitable torque wrench. Tighten the nuts alternately.

(3) After assembling the main plane to the fuselage, and before fitting the seven shear bolts (6) attach with rubber resin cement Ref. No. 33H/2245977 a sealing block Part No EA1.20.2899. The block must be hard up to the forward face of the spar lower boom and the fuselage side as shown in detail.

(4) At the forward attachment point (55) the attachment bolt (53) is a ½ in. dia. B.S.F.(A59/11N). It is to be torque tightened to 100 lbf in.

Note. . .

This bolt must be removed, discarded and replaced with a new bolt at each subsequent Minor Star Servicing (S.T.I./Can./604).

(5) When securing the main plane skin to the fuselage attachment angle, the sixty-eight 2 B.A. screws securing the leading-edge skin, from the main spar on the upper surface, to the forward edge of the main undercarriage bay, must be fully tightened and then slackened off one quarter of a turn; this ensures freedom of movement between the wing and the fuselage.

(6) When fitting a new main plane refer to A.P.101B-0400-6, Part.1.

Note. . .

Whenever a main plane is refitted, or replaced, a flight trim check must be made in accordance with Sect.3, Chap.4, App.1, to ensure that the aircraft trim is within the specified limits. Should the aircraft trim be outside the specified limits, a new elevator trailing edge strip must be fitted and the flight trim checks and subsequent trailing-edge strip adjustments made. ▶

KEY TO FIG.7 (AILERON AND AILERON TAB - REMOVAL AND ASSEMBLY)

To remove an aileron:-

- (1) Remove the wing-tip pod (Sect.5, Chap.5), or wing-tip fuel tank (Sect.4, Chap.2) if fitted.
- (2) Open all aileron shrouds by removing the countersunk screws at the extremities of each shroud.
- (3) Disconnect the aileron control rod from the aileron lever (detail E).
- (4) Remove the access panel from the underside of the wing tip (detail B).
- (5) Remove the four ¼ in. dia. bolts attaching the centre hinge bracket to the aileron (detail D) and note the number of shims. To facilitate the removal of these bolts, the centre shroud attachment brackets may be removed (detail D).

Note . . .

In the event of the centre hinge shroud attachment brackets being removed, note the number and position of shims Ref.No.26FZ/6143. During reassembly, check the shroud and attachment bracket bolt holes for alignment and fit shims as

necessary to ensure that no gap exists between the aileron centre hinge and shroud attachment brackets.

- (6) Lower the flaps, support the aileron at its extremities, remove the nut and bolt from the inboard hinge pin and, using extractor Ref.No.26FZ/95104, withdraw the hinge pin (detail A).
- (7) Remove the nut and bolt from the outboard hinge pin and, using extractor Ref.No.26FZ/95104, withdraw the hinge pin (detail B).
- (8) Remove the aileron.

To remove an aileron tab:-

- (1) Remove the two countersunk screws attaching the control rod fairing to the aileron and remove the fairing (detail G).
- (2) Remove the four 2 B.A. bolts and the two countersunk screws attaching the centre hinge bracket to the tab (detail G).

Note . . .

Tabs bearing serial numbers prefixed with letters GEO/EEP or GEO/R3/EA3;

when refitting bolts and screws removed in operation (2), check for adequate locking. If unsatisfactory, remove the bolts and screws and fit shakeproof washers AGS.2035/C to the bolts or AGS.2036/C to the screws. When AGS.2036/C washers are fitted, check the clearance between the heads of the screws and fairing edge.

- (3) Remove the locking wire from the inboard hinge pin, and, with the tab adequately supported, remove the hinge pin (detail C).
- (4) Remove the tab from its outboard hinge pin by drawing the tab inboard (detail E).

Note . . .

A flight trim check must be made in accordance with Sect.3, Chap.4, Appendix 1, whenever an aileron or aileron tab is replaced or adjusted, to ensure that the aircraft trim is within the limits laid down. Should the aircraft trim be outside the limits specified, a new elevator trailing-edge strip must be fitted and the flight trim checks and subsequent trailing-edge strip adjustments made.

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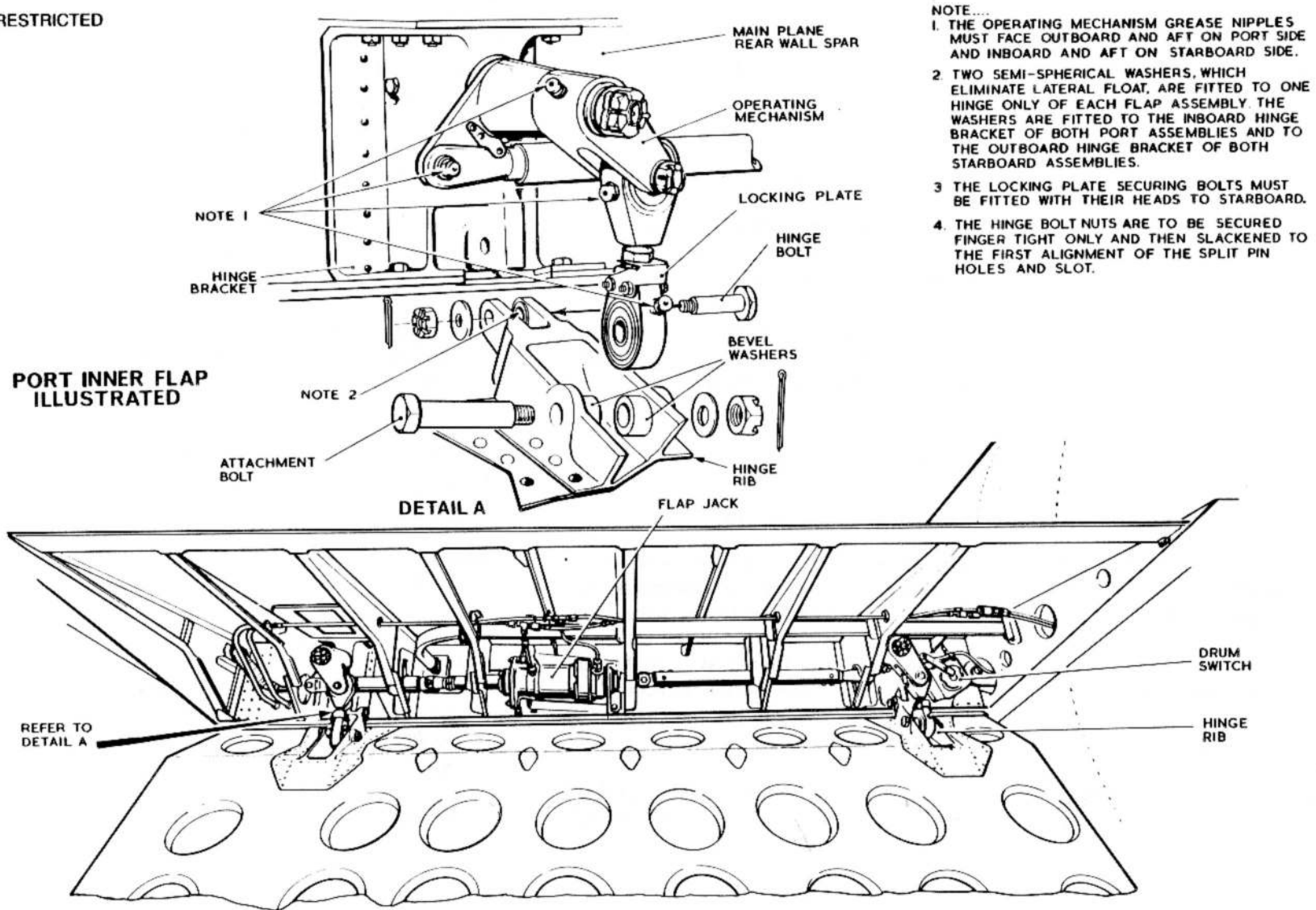


FIG.8. FLAP - REMOVAL AND ASSEMBLY

◀ PIPE RUN AMENDED ▶

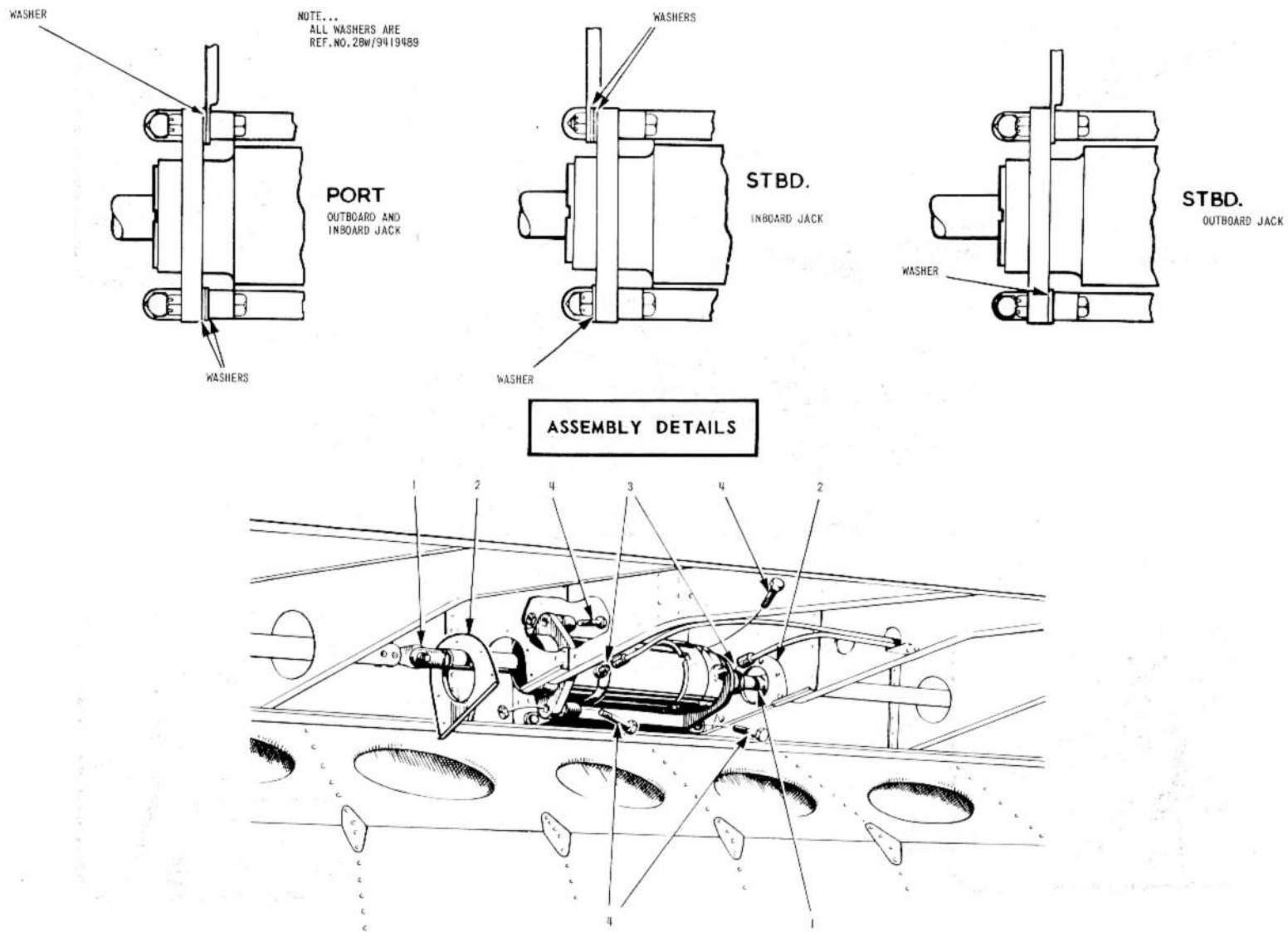


FIG. 9. FLAP JACK - REMOVAL AND ASSEMBLY

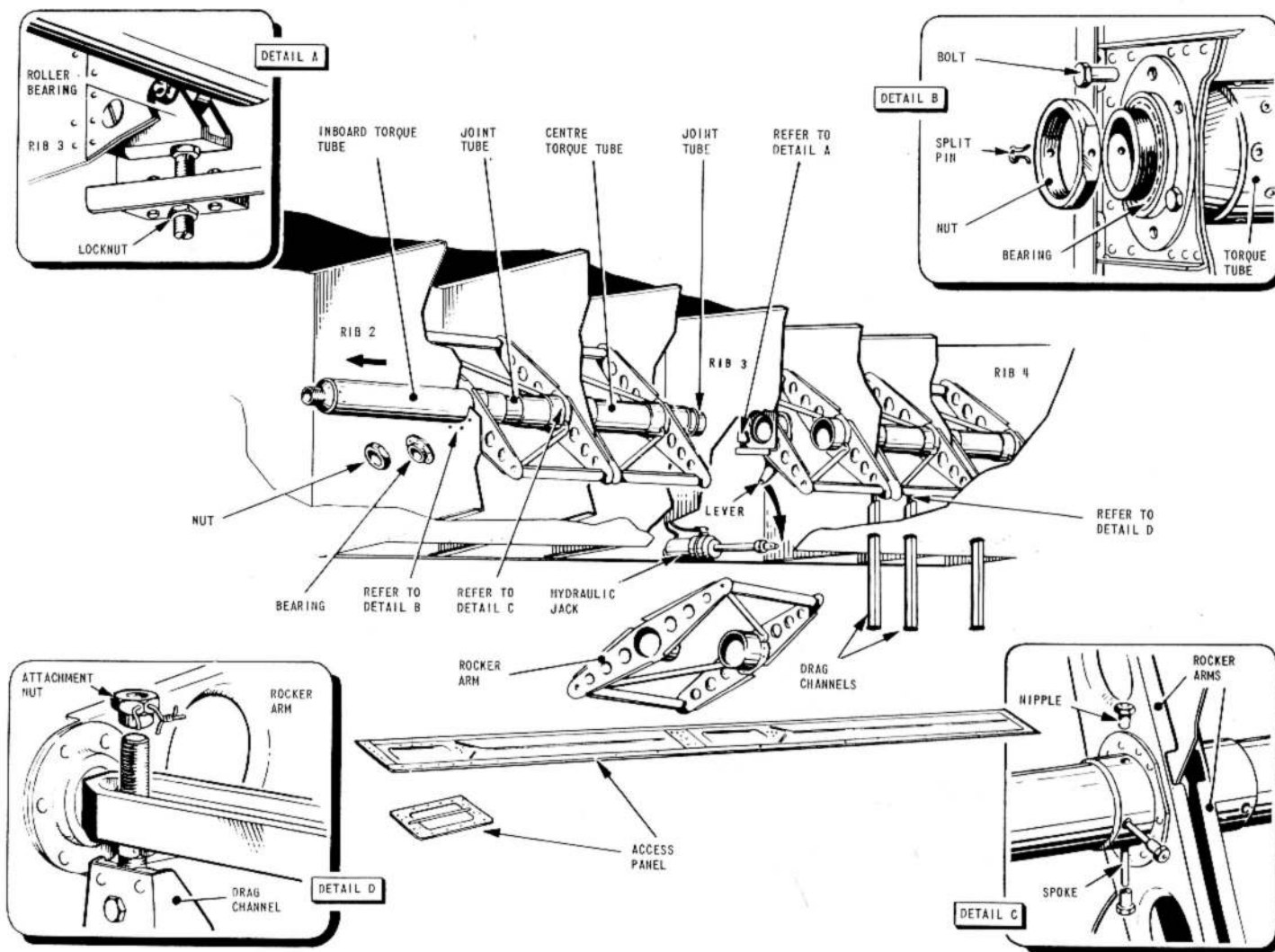


FIG. 10. AIR BRAKES - REMOVAL AND ASSEMBLY

◀ KEY TO FIG.8 (FLAP - REMOVAL AND ASSEMBLY)

Removal

To remove a flap proceed as follows:-

Note . . .

Removal and assembly procedure is common to all flaps.

- (1) Select flaps DOWN and lower the flaps fully.
- (2) Support the flap and remove the attachment pin B from both operating mechanisms. Record the position of the bevel washers to assist in reassembly. Retain the attachment pins, bevel washers, plain washer and slotted nut.
- (3) With the flap adequately supported at its centre and extremities, remove the hinge pin A from both hinge brackets. Retain the hinge pins, slotted nuts, plain washers and at the datum hinges only, note the position of and retain the semi-spherical washers.
- (4) Move the flap aft and downwards and remove it from the main plane.

Assembly

Reassembly of the existing flap to the main plane is a reversal of the removal procedure with care being taken to ensure that the bevel and spherical washers, retained during removal of the flap, are refitted correctly in their original positions.

Note . . .

Hinge pin nuts are to be tightened finger tight only, and slackened back to the first alignment of the split pin hole and slot.

If a new flap is fitted to the main plane, check for correct clearances (*fig.5*). If the clearance between the leading edge of the flap and the main plane is incorrect (*Section A-A*), it may be adjusted by filing the leading edge of the flap. Ensure that the 45 deg. chamfer is maintained on the leading edge of the flap. Protective treatment (*A.P.119A-0509-1*) must be applied to all filed surfaces.

KEY TO FIG. 10 (AIR BRAKES - REMOVAL AND ASSEMBLY)

To remove an air brake: -

(1) Remove the access panel in the lower surface of the main plane (Sect. 2, Chap. 4).

(2) Disconnect the hydraulic jack at the lever on the rocker arm assembly.

(3) Disconnect and remove all drag channels by unlocking and removing their attachment nuts (detail D).

(4) Remove the nipples and spokes from all rocker arm assemblies and joint tubes (detail C).

(5) Slacken the locknut on the adjustable roller on the bearing on rib 3 and

lower the roller to its full extent (detail A).

(6) Remove the nut from the end of the torque tube at rib 2, and the bearing on that rib, after removing the bolts securing its annular plate (detail B).

(7) Slide the inner and centre portions of the torque tube inboard, toward rib 1, removing the rocker arm assemblies and the joint tube from the main plane as they are released.

(8) Separate the centre and inner portions of the torque tube, removing the rocker arm assemblies and joint tube as they are released.

(9) Move the centre portion of the tube to rib 3 and, pivoting it on the adjustable roller, remove it from the main plane.

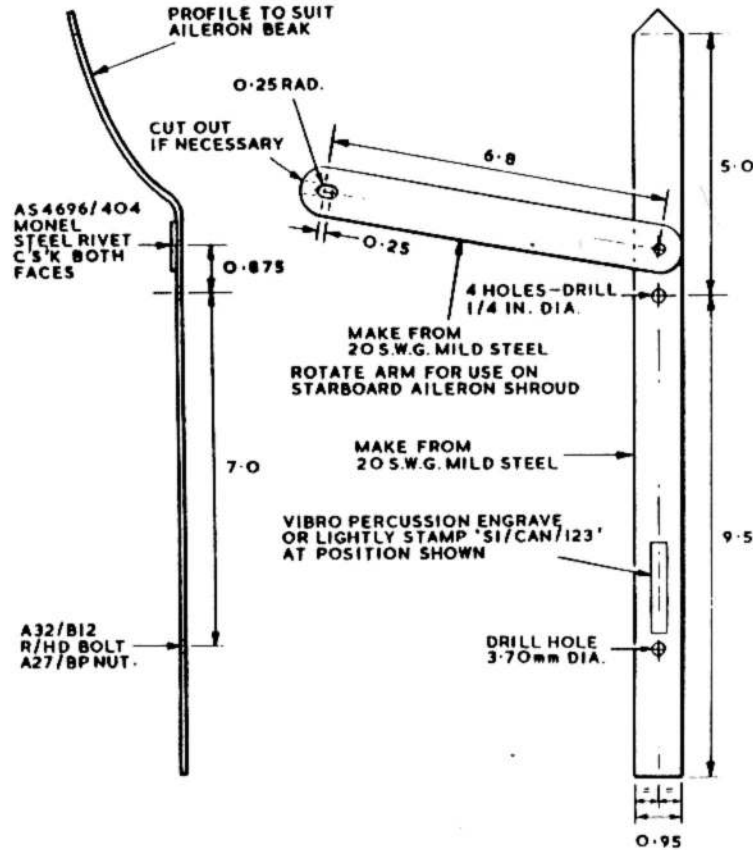
(10) Move the inner portion of the torque tube to rib 3 and remove it from the main plane as for the centre portion.

(11) Remove the outer portion of the torque tube from the main plane in a similar manner, removing the remaining rocker arm assemblies as they are freed.

Assembly Note...

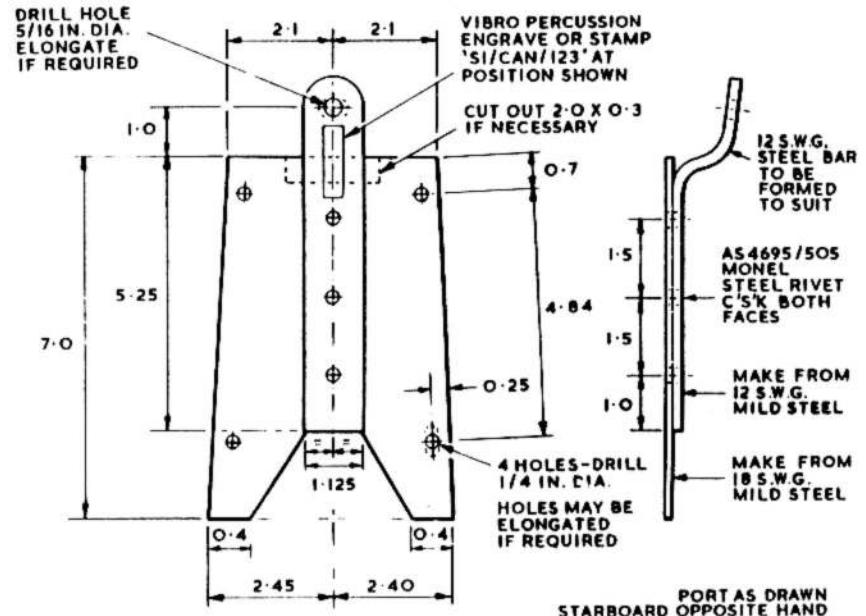
After assembly of an air brake, set the air-brake mechanism (Sect. 3, Chap. 4).

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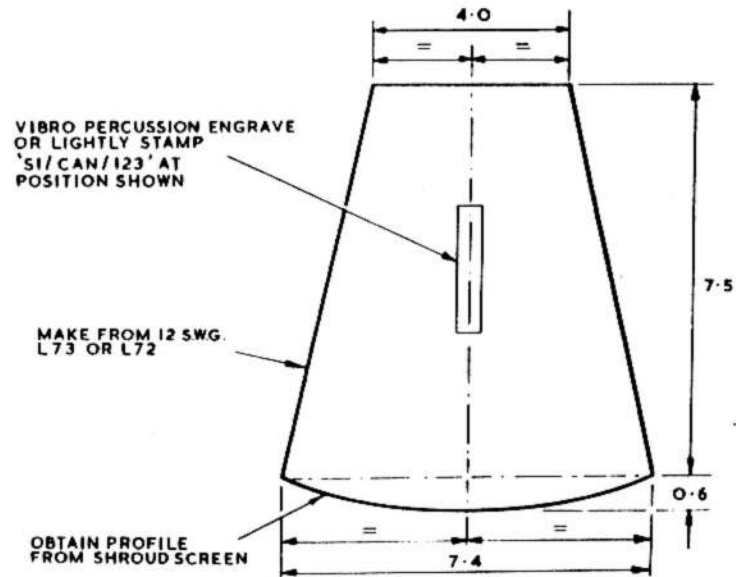


LOCATING JIG (INBOARD SHROUD)

NOTE... ALL DIMENSIONS ARE IN INCHES, UNLESS OTHERWISE STATED



LOCATING JIG (CENTRE SCREEN)



CLEARANCE GAUGE

FIG.12. AILERON CLEARANCE GAUGES

◀ New illustration ▶

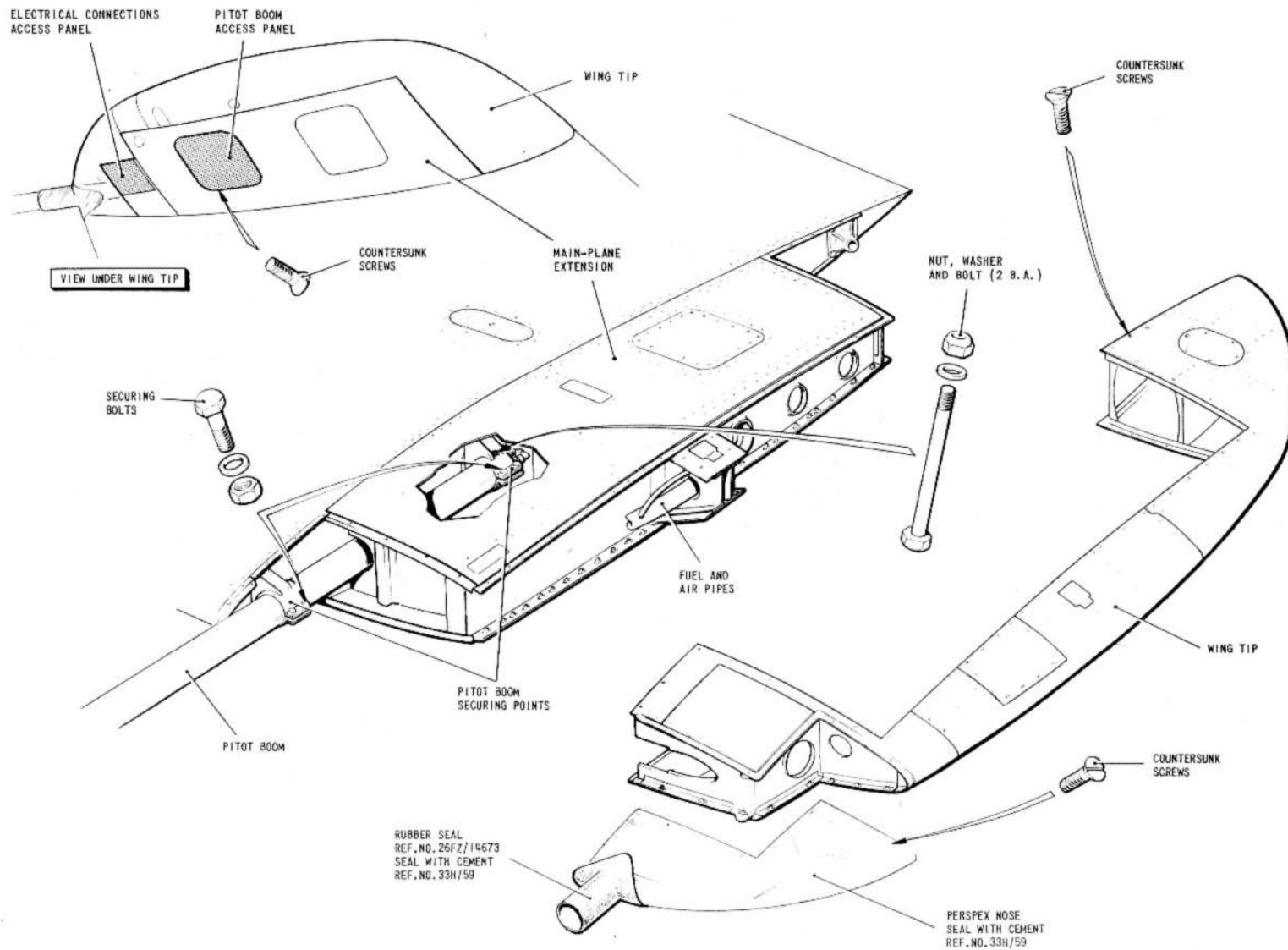


FIG.11. WING TIP / PITOT BOOM - REMOVAL AND ASSEMBLY

Chapter 3 TAIL UNIT

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<i>Tail-plane, elevators and tabs</i>	<i>Elevator and elevator tab removal</i>
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<i>Rudder and rudder tab</i>	<i>Fin - removal and assembly</i>
<i>Tail plane slinging</i>	<i>Tail-plane clearances</i>
<i>Tail-plane seals</i>	<i>Fin, rudder and elevator clearances</i>

Introduction

1. This chapter gives a general description of the tail unit structure and pictorially describes the removal and assembly operations. The disposition of the spars and ribs within the structure is illustrated in fig.1.

DESCRIPTION**Tail plane (fig.2)**

2. The electrically-actuated variable-incidence tail plane is a single-spar structure with a false rear spar, built as port and starboard units which are connected together at their roots to form a single assembly. The spar has extruded T-section booms, and a plate web stiffened with angle sections; the false rear spar, which

carries the elevator hinge attachment brackets, is a flanged plate stiffened with angle sections. Flanged plate ribs, stiffened with angle-section members, join the main and false spars, the ribs being cut away to accommodate bulb angle-section spanwise stringers. The leading-edge ribs are continuations of those aft of the spar and are of similar section, the inboard faces of those at the root being faced with spruce strips. Each unit is covered with a light-alloy skin riveted to the ribs, stringers and spars and post Mod.5536, strengthened along the main spar upper and lower surfaces, by reinforcing plates. A forged light-alloy centre section connects the port and starboard units at the spars whilst the false spars are joined directly to each other, the triangular aperture thus formed being plated with top and bottom skins which are supported on three diaphragms and spanwise stringers. The complete tail-plane is carried on two brackets on the fuselage at the rear of frame 42 by fork-end brackets on the forward face of

the centre section forging, and is supported near the false spar by an electrical actuator. Mod.1277 introduces sealing strips between the tail plane and rear fuselage.

Elevators (fig.2)

3. Each elevator has a D-section spar, forming the leading edge, with flanged plate ribs and a light-alloy skin covering behind the spar and over the horn and is hinged to the tail plane at its centre and extremities. The inboard ribs are cut away at their trailing edges and are bounded by a plate web to which the tab hinge brackets are attached, the skin being extended beyond the web to form a shroud over the leading edge of the tab. Interconnection of the elevators is effected by vertical torque levers riveted to flanges at the root of each spar, the levers being joined at their ends by a coupling link. The elevators are mass-balanced by bob weights mounted on tubular arms projecting from the leading edge into the interior of the tail plane. On the underside of the elevators, at the centre hinge positions, Mod.4160 introduces an access panel, secured by rivets, for examination and replacement of the centre hinge brackets. Static discharge wicks are fitted to the trailing edge of each elevator.

Elevator spring and balance tabs (fig.2)

4. The elevator spring and balance tabs are hinged to the elevators by end hinges and two intermediate hinge pins, the spring tab being mounted on the port elevator and the balance tab on the starboard elevator. The skin covering is attached to a tubular spar and pressed flanged ribs, the tabs being balanced by spanwise mild steel tubes attached to the spar and protruding into the elevator interior.

Fin (fig.3)

5. The fin is a composite structure of wood and metal, built around a single light-alloy spar consisting of T-section booms and a plate web reinforced by angle sections. The leading-edge structure is formed by wooden ribs, with stiffeners, and a metal leading-edge member, the whole being covered with a plywood skin, which is Reduxed at its aft edge to the outside of the T-section booms forward of the spar web. Aft of the spar the structure is entirely of metal construction, consisting of flanged plate ribs, with angle-section stiffeners, and a curved rear wall forming the rudder shroud. The rudder upper hinge plate is attached to rib 6 at the top of the shroud.

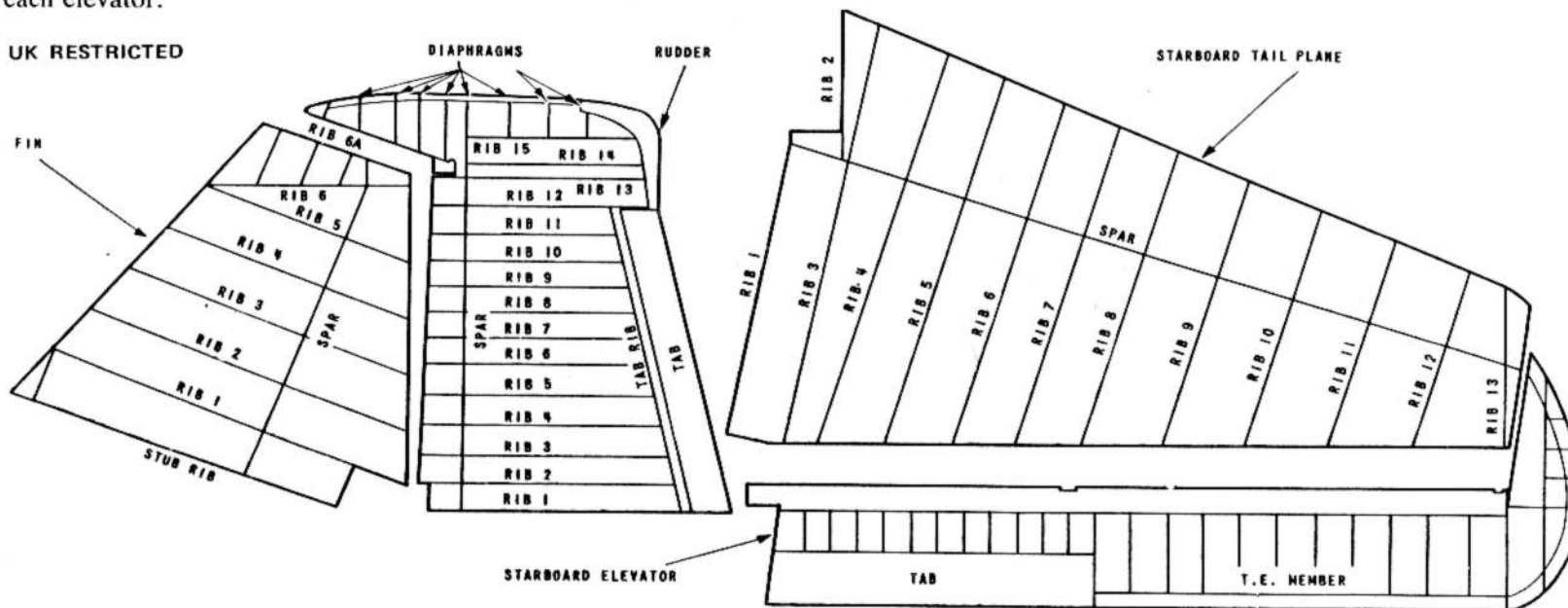


Fig.1. Key diagram

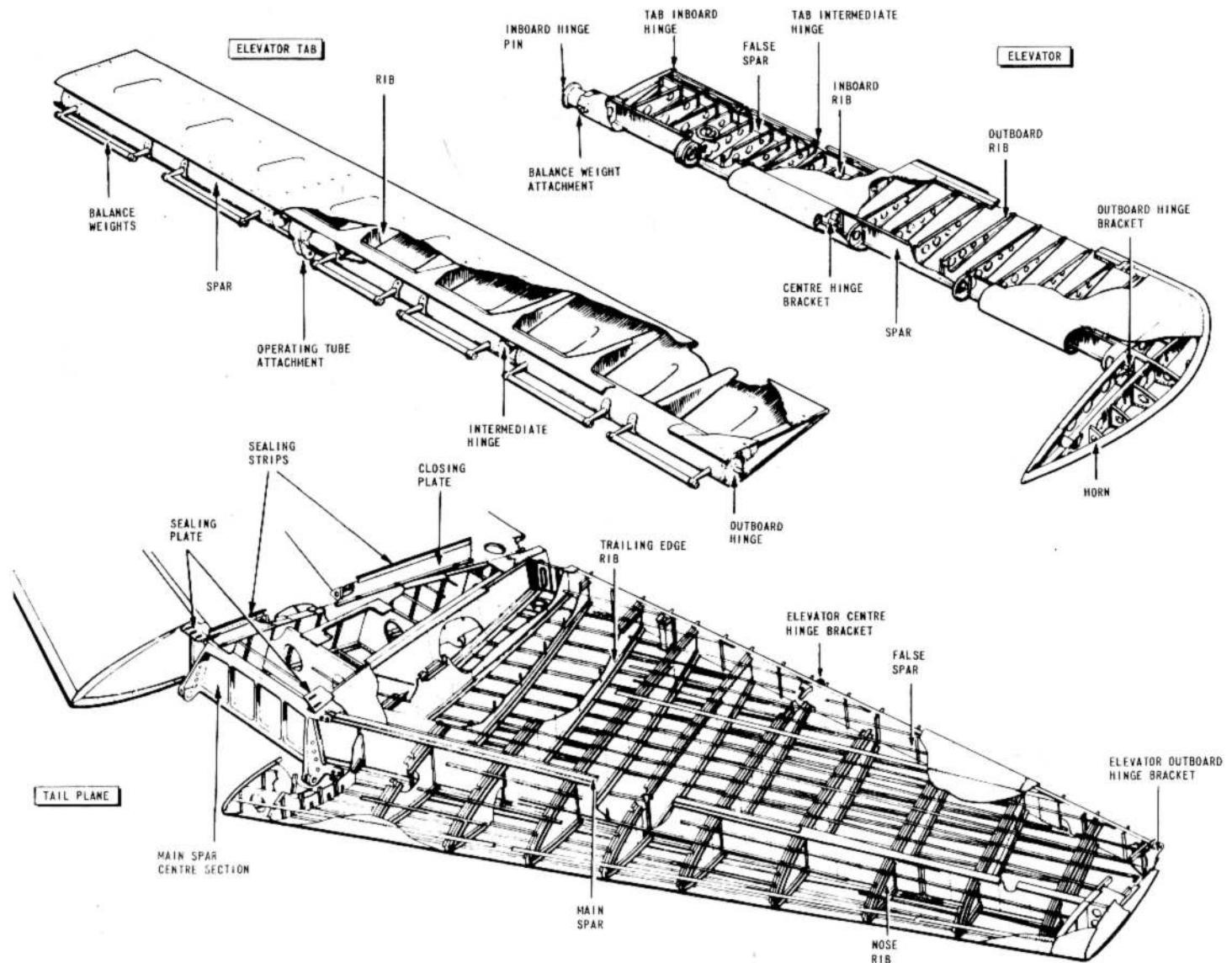


FIG. 2. TAIL PLANE, ELEVATORS AND TABS

Rudder (fig.4)

6. The rudder is an all metal structure comprising a built-up spar, flanged plate ribs aft of the spar and D-shaped leading-edge ribs. At the upper end, a horn extends forward of the spar and this, together with the upper edge of the rudder, is built up with vertical diaphragms. Ribs 1 to 11 are shortened at their trailing edges and are bounded by a plate web, to which is attached the tab centre hinge bracket; the tab upper hinge socket is mounted on rib 12 and the lower hinge bracket is attached to the underside of rib 1. The whole structure is covered with a light-alloy skin which extends beyond the trailing-edge plate web to form the tab shroud. The rudder is hinged to the fin rear wall at its upper end, is supported in a bearing in the rudder stub of the rear fuselage at its lower end, and is mass-balanced by two weights, one mounted in the rudder horn and the other attached to an arm at the bottom of the spar. Static discharge wicks are fitted to the trailing edge of the rudder.

Rudder spring tab (fig.4)

7. The rudder spring tab is similar in construction to the elevator spring and balance tabs (para.4), and is hinged to the rudder by upper and centre hinge pins and a lower hinge bracket. The tab is balanced by weights carried on arms attached to the spar and protruding into the rudder interior. Static discharge wicks are fitted to the trailing edge of the tab.

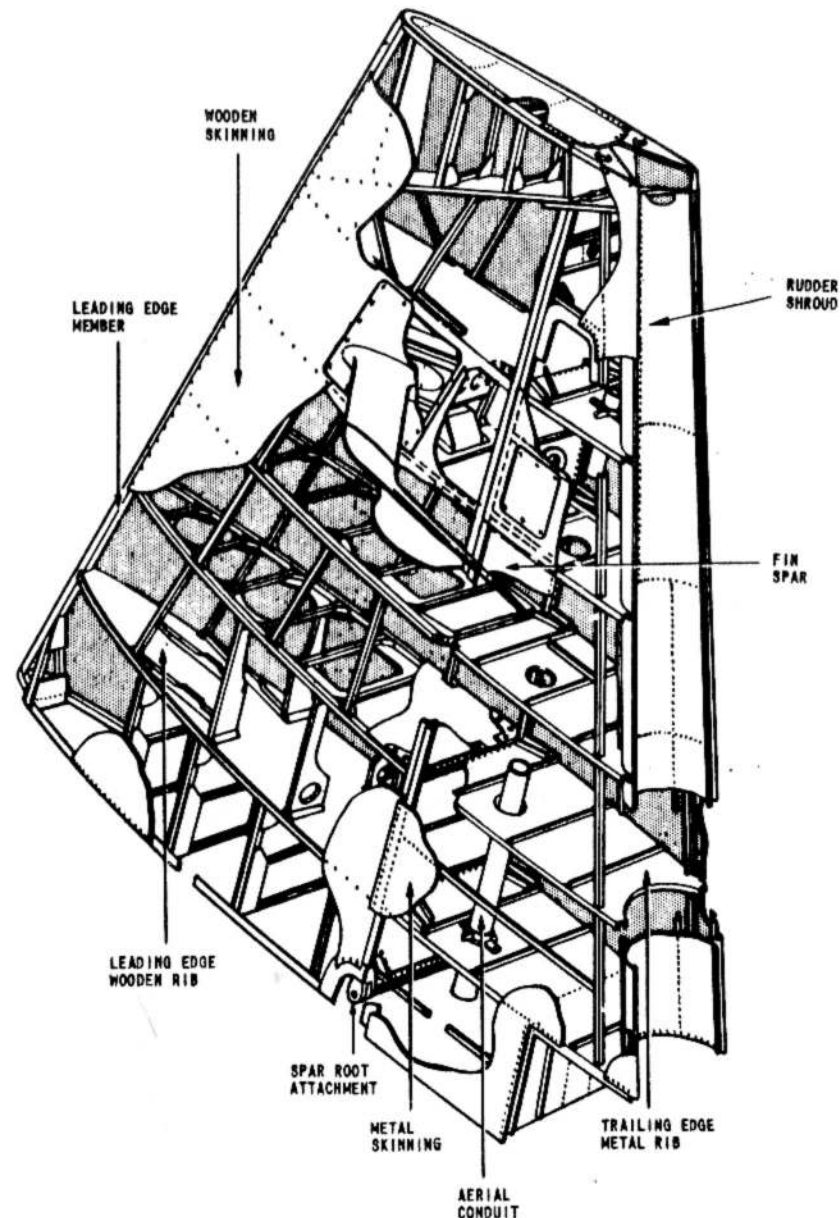
SERVICING**General**

7A. The only servicing normally required on the tail unit is the lubrication of hinges and hinge bearings. Details of flying control connection lubrication is given in Chap.4. The following require periodic lubrication:-

- (1) The rudder upper, lower, and tab hinge bearings, and the elevator tab hinges; to be greased with XG-287.
- (2) The tail plane hinge pins; one nipple on each pin to be greased with XG-287.
- (3) The elevator hinges and the tail plane actuator attachment points to be oiled with OX-14.

REMOVAL AND ASSEMBLY**Note**

Following removal, reassembly, or adjustment of any component which may effect the longitudinal trim of the aircraft, carry out flight trim checks as detailed in Sect.3, Chap.4, App.1.

**Fig.3. Fin**

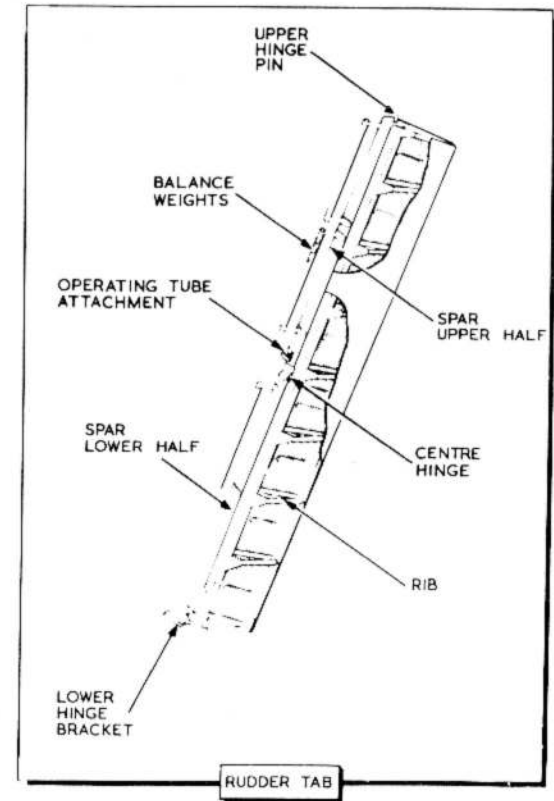
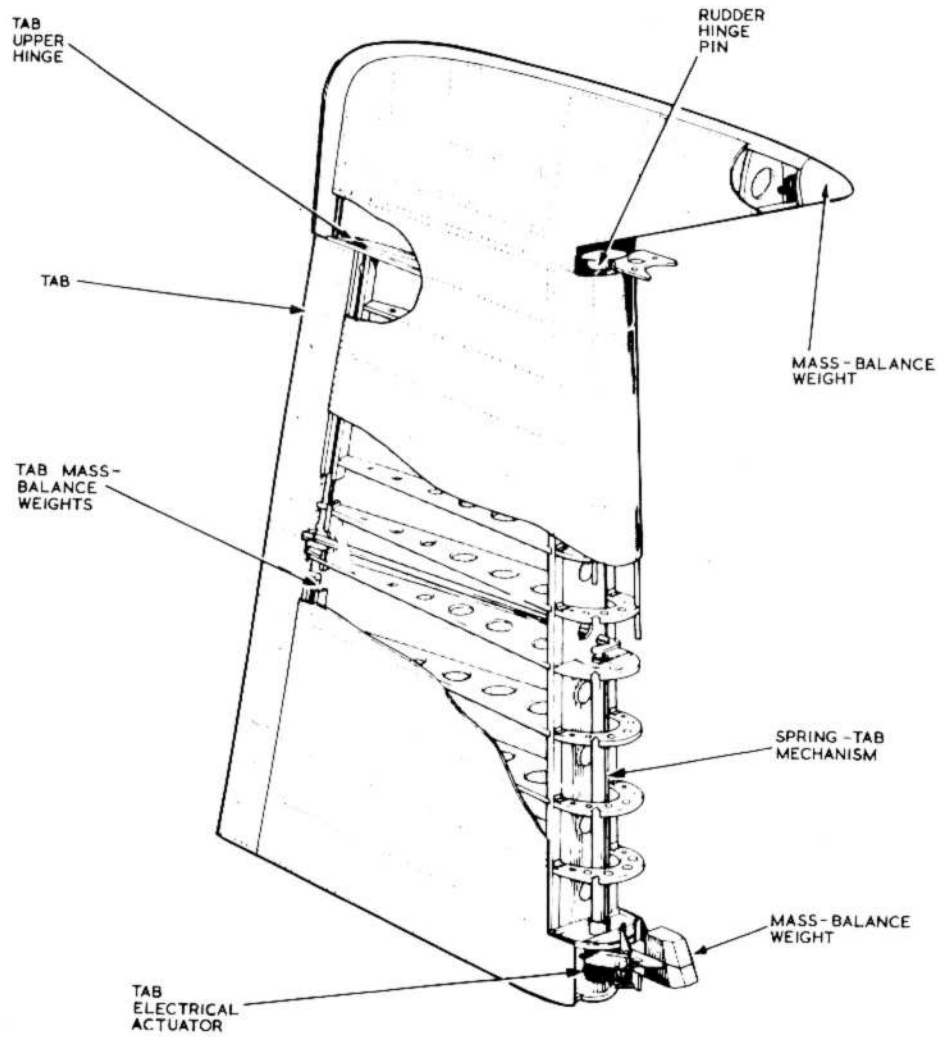


FIG.4 RUDDER AND RUDDER TAB

WHEN USING TOWING CRANE
TYPE A, REF NO. 4L/2023,
MAX. HEIGHT OF LIFT IS 6-0 IN.
ABOVE THE INSTALLED POSITION.

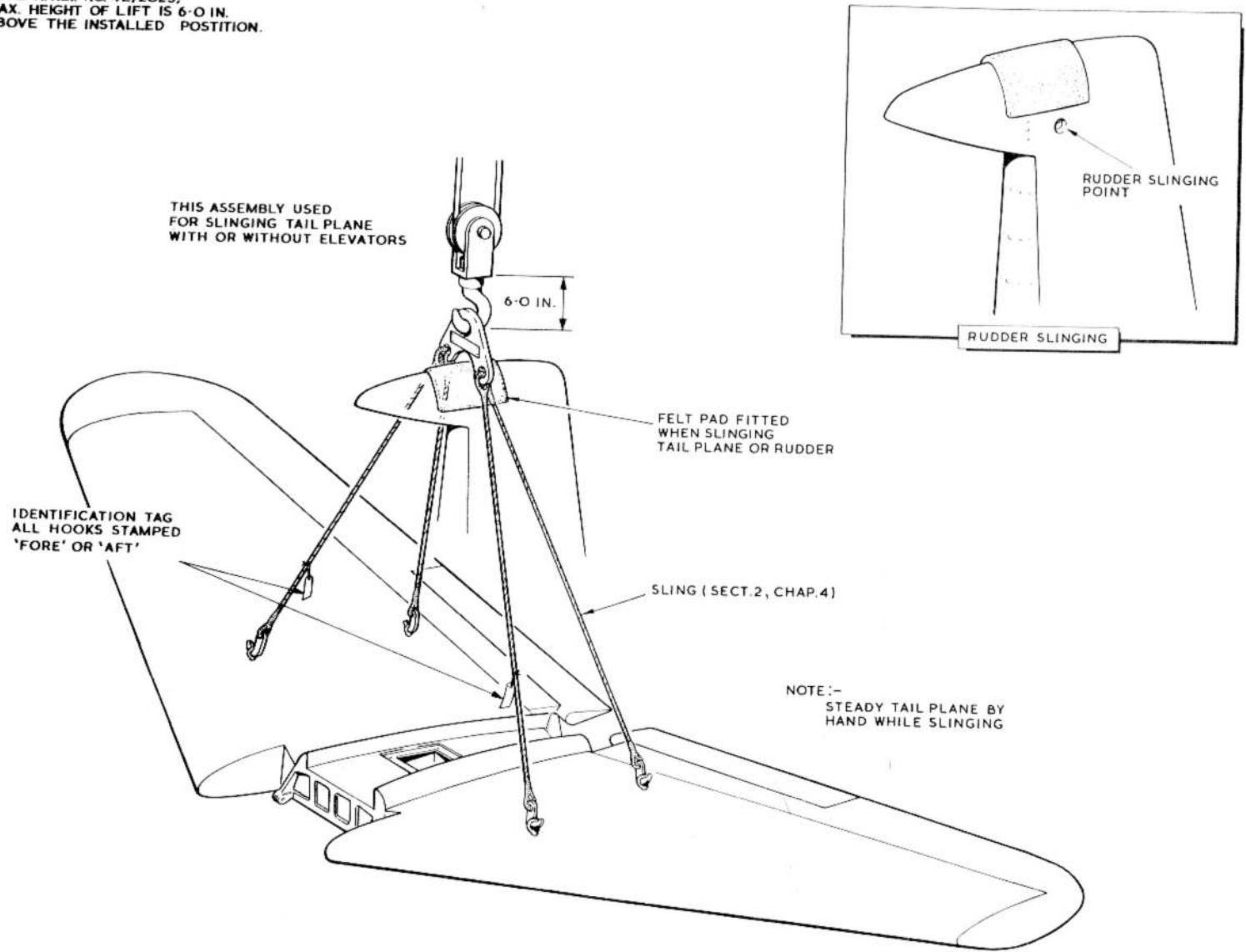


FIG. 5. TAIL PLANE SLINGING

◀ SLING HOOKS REVERSED ▶

General information

8. The methods of removing and assembling the components of the tail unit are given in the keys to fig.7 to 10. Only the removal operations are given in detail since the assembly is generally a reversal of this detail; where this is not the case the fact is noted.

Shroud clearances (fig.12)

9. After fitting a new rudder to the fin, or a tab to either the rudder or elevator, the gap between the shroud and the leading edge of the component must be checked, it should be 0.05 ± 0.02 in. (details C and B). After fitting a new elevator to the tail plane, the gap

between the shroud and the leading edge of the elevator must be 0.090 ± 0.050 and 0.050 ± 0.030 (detail A). If these measurements are not obtained the edges of the shroud may be trimmed by filing.

◀ Protective treatment (A.P.119A-0509-1) ▶
must be applied to all filed surfaces.

Slings (fig.5)

10. The cables of the sling are identified for fore and aft positions by tags attached to the cables. Only a six-inch lift above the installed position is permissible, and care must be taken not to foul the underside of the rudder stub

when lifting. The rudder and fin are slung by passing a strap through the holes at the positions indicated in Sect.2, Chap.4. These holes in the fin are normally covered with fabric patches; those in the rudder are closed by spring-loaded plugs which are removable by screwing a 4 B.A. bolt into the hole in the plug and pulling outwards.

Tail-plane seal adjustment (fig.6)

11. The clearance between the tail-plane fairing and the sealing strip is adjusted by means of the 10 adjusting screws, five on each side of the tail-plane stub. On no account must these screws be fully tightened.

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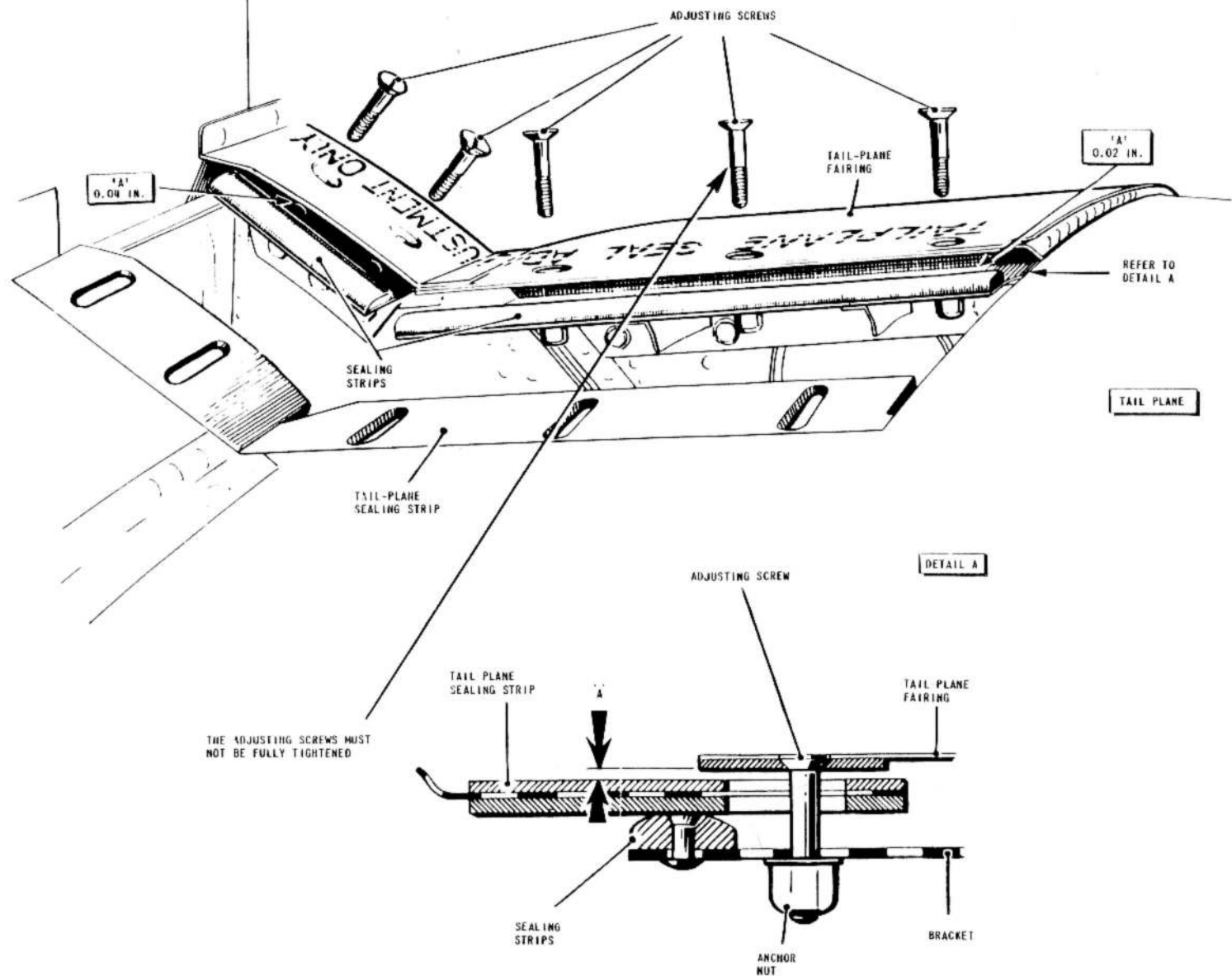


FIG.6. TAIL - PLANE SEALS

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KEY TO FIG. 7 (TAIL PLANE REMOVAL)

The tail plane may be removed with or without the elevators fitted. With the elevators removed:-

(1) Jack and trestle the aircraft (*Sect. 2, Chap.4*), and attach the sling to the tail plane. Take up the slackness in the sling.

(2) Remove the tail-plane actuator (*Sect.3, Chap.4*).

(3) Remove the ten adjusting bolts from the tail-plane stubs (five each side) which secure the sealing plates.

(4) Remove the circular access panel on the port side of the fin stub (*Sect. 2, Chap.4, fig.6*). This panel gives access to the bracing strut upper attachment

(5) Remove the split pin, nut, and washer from the bolt (4) attaching the bracing strut (3) to the lug (5) on the rear of frame 42, and remove the bolt.

(6) Move the tail plane to its minimum incidence by lifting with the sling.

(7) Remove the split pin, nut, and washer from the bolt (2) attaching the bracing strut (3) to the lug (1) on the rear fuselage.

(8) Remove the bolt (2) and withdraw the strut (3).

(9) Remove the split pin, nut, and washer from each hinge pin (8).

(10) Withdraw the hinge pins (8) from

the lugs on the spar centre section (6), and hinge brackets (7) on the rear fuselage. The tail plane is then free to be removed.

With the elevators attached:-

(1) Jack and trestle the aircraft (*Sect.2, Chap.4*), and attach a sling to the tail plane. Take up the slackness in the sling.

(2) Remove the box fairing and the rear fairing (*Sect.3, Chap.1*).

◀ (3) Disconnect the control rod from the port elevator lever and at the lever on the bulkhead at fuselage frame 42.

(4) Remove and retain the disconnected section of the control rod.

(5) Proceed as instructed in operations (2) to (10) for the removal of the tail plane with the elevators removed.

Assembly details

Before assembling any tail plane, ensure that all contact faces of moving parts of the lugs on the spar centre section (6) and hinge brackets (7) on the rear fuselage, are coated generously with grease XG-276.

When fitting a new tail plane (*fig.11*):- ▶

(1) Before commencing, ensure that the lower cover plate, on the port side of the rudder stub, is securely positioned (access to this plate is not possible with the tail plane in position).

(2) Check the clearance between the sealing plate on the underside of the tail plane and the closing strip on the fuselage (this clearance must be checked before the installation of the tail-plane actuator) as follows:-

(a) Ensure that the lower micro-switch tappet is fully screwed back.

(b) Set the tail plane to 5 deg 42 min incidence, measured at the starboard inboard rigging position (at this incidence the sealing plate and the closing strip are adjacent over practically their whole length, and the clearance can be ascertained).

(c) Check the clearance as stated in detail B (lower dimension).

(3) With the tail-plane actuator installed, set the tail plane to 3 deg 15 min incidence (measured at the starboard inboard rigging position, or at the take-off position on the cabin gauge) and check the following clearances:-

(a) Between the tail plane and the tail-plane stub; this should be as in detail A. If this dimension is not obtained, the clearance may be adjusted by adding extra packing, or facing-off existing packing on the tail plane as required.

(b) Between the tail plane and the forward face of the rear cone; this should be as position E.

(c) Between the tail plane box

continued...

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KEY TO FIG. 7. (TAIL PLANE REMOVAL) - *continued*

fairing and the fuselage: this should be as in detail B (upper dimension).

(two-bolt position) and the tail-plane stub, as in detail C.

freedom of movement throughout the full range of tail-plane travel.

(4) Set the tail plane in line with tail-plane stub, and adjust the sealing strips to give the following clearances: -

(b) Between the sealing strips (three-bolt position) and the tail-plane stub, as in detail D.

Note...

Whenever a tail plane has been replaced or adjusted, flight trim checks must be made as detailed in Sect. 3, Chap. 4, App. 1, to ensure that the aircraft trim is within the limits laid down.

(a) Between the sealing strips

(5) Ensure that there is complete

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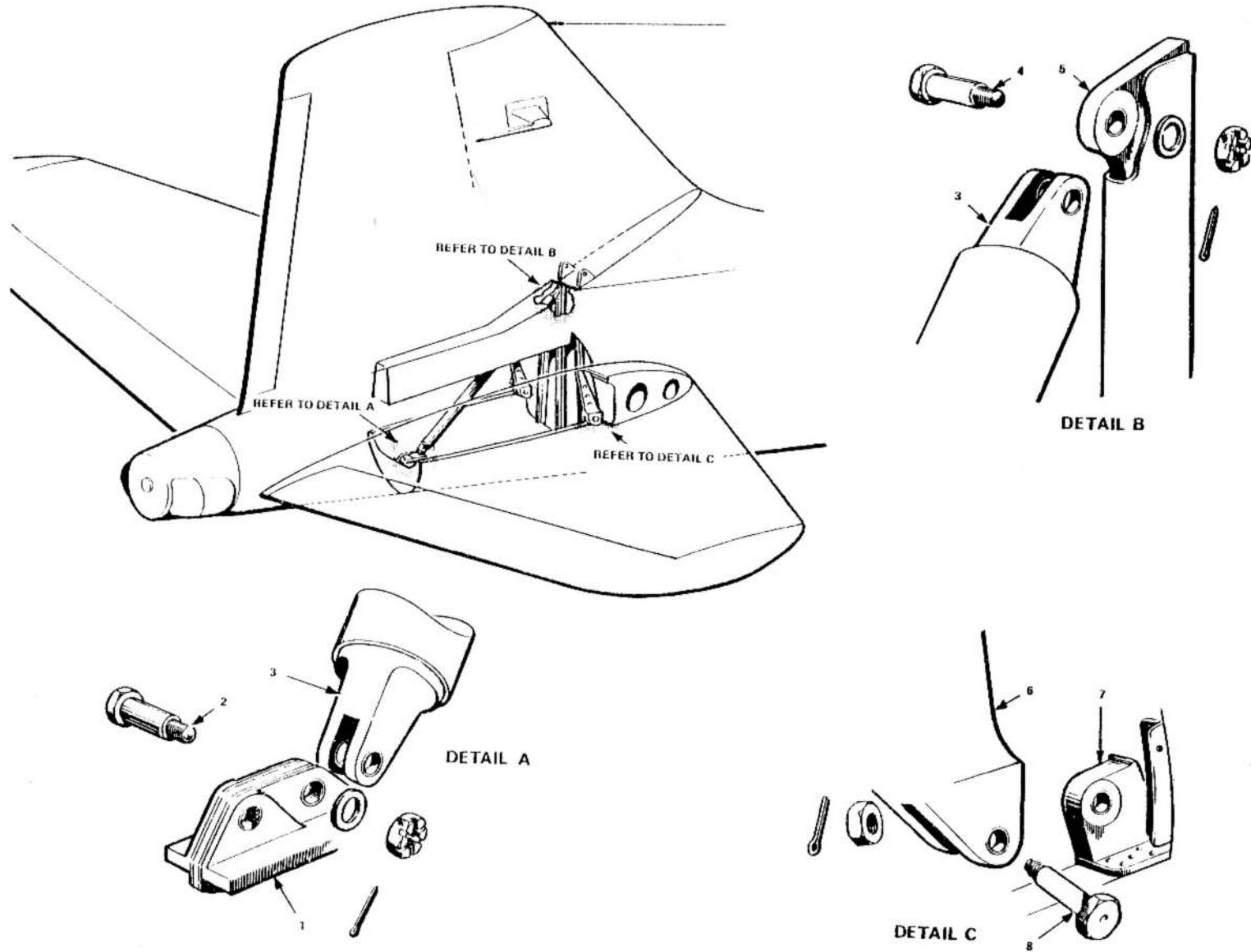


FIG.7. TAIL-PLANE REMOVAL

◀ DETAIL AMENDMENT ▶

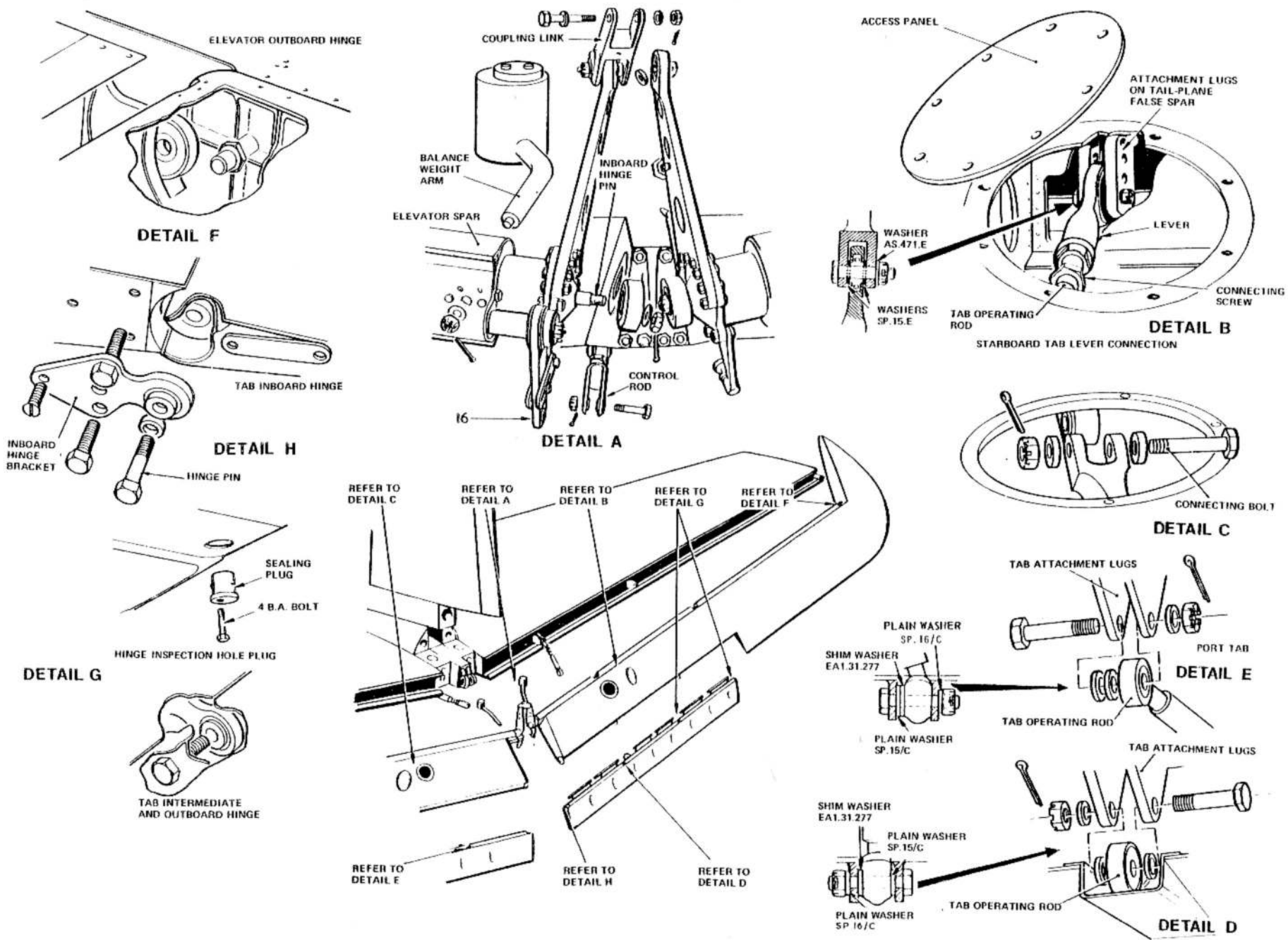


FIG.8. ELEVATOR AND ELEVATOR TAB REMOVAL

◀ DETAIL B AMENDED ▶

KEY TO FIG. 8 (ELEVATOR AND ELEVATOR TAB REMOVAL)

► *Elevator removal*

- (1) Set the tail plane to its mid-travel position.
- (2) Remove the box fairing and the rear fairing as instructed in Sect. 3, Chap. 1.
- (3) Disconnect the control rod from the lever (*detail A*).
- (4) Remove the access panel from the upper surface of the starboard elevator. This panel gives access to the connecting screw on the operating lever of the starboard tab (*detail B*).
- (5) Disconnect the starboard tab-operating lever at the connecting screw.
- (6) Remove the split pin, nut and washer from each balance weight arm and withdraw the balance weights and arms from the elevator spars (*detail A*).
- (7) Disconnect the coupling link from the starboard elevator.
- (8) Remove the split pin, nut and washer from the inboard hinge pin of the port elevator.
- (9) Remove the port elevator from its hinges by moving it outboard, until it is clear of the centre and inboard hinges, and then aft.
- (10) Proceed as instructed in operations (8) and (9) with the starboard elevator.

Elevator assembly

The assembly of the elevator is the reverse of the removal sequence.

Note. . .

To enable the alignment of the centre and outboard hinges to be checked during reassembly, apertures closed by spring loaded sealing plugs, are provided on the underside of the elevators at these hinge points. To remove, screw a 4BA bolt into the hole in the plug and pull outwards; to replace, remove the bolt, insert the plug in the aperture and press it home. Ensure that the plug is flush with the elevator skin (detail G). The bolt securing the coupling link must, when inserted have its head to port.

Elevator tab removal

- (1) Remove the access panels, port and starboard, and, at this point

disconnect the tab operating rod from the lever by removing the connecting screw, in the case of the starboard tab, and by removing the connecting bolt in the case of the port tab (*details B and C*).

- (2) Disconnect the tab operating rod from the tab, and move the operating rod clear of the attachment lugs (*details D and E*).
- (3) Remove the inboard hinge bracket (*detail H*).
- (4) Raise the tab and remove it by moving it inboard until it is clear of the outboard and intermediate hinges, and then aft.

Note. . .

If new tabs are to be fitted, it will be necessary to remove the inboard hinge pin. The pin is to be wirelocked on reassembly (detail H).

Elevator tab assembly

The assembly of the elevator tab is the reverse of the removal sequence :-

Note. . .

1. Before assembly, inspect the extreme end of the tab operating rod and the surface between the two lugs of the tab hinge fitting. Where a foul has occurred, clear it by lightly filing a small flat between the two lugs at the point of contact, so that a minimum clearance of 0.005 in is obtained. The width of the slot is not to exceed the width of the rod end, and the amount of metal removed should not exceed 0.010 in. in depth.

2. When a new or replacement tab is to be fitted it must be checked for loose balance weights which are rivetted to the inner face of each end rib. Check by tapping the skin and ribs at each end; loose weights will be indicated by a rattling sound. Repair as detailed in S.P.'s for elevator balance tabs.

3. When assembling an elevator tab, ensure that the tab rod is connected to its attachment lugs with bolt Pt. No. EA1.31.65, and that no load is placed on the operating rod attachment lugs when the nut is tightened, by fitting the plain and shim washers as follows :-

4. For the port tab, (detail E) the thin plain washer Pt. No. S.P.15/C and shim Pt. No. EA1.31.277 must be positioned between the ball race and the outboard bracket, and the plain washer Pt. No. S.P.16/C between the nut and the inboard bracket. For the starboard tab (detail D) the thin plain washer must be positioned between the ball race and the outboard bracket, the shim between the ball race and the inboard bracket and the

KEY TO FIG. 8 (ELEVATOR AND ELEVATOR TAB REMOVAL) -continued

- ▶ other plain washer between the nut and the inboard bracket. Lock the nut with a new split pin. It may be necessary to tap the bolt through the ball race in the tab operating rod; the tapping must be as light as possible to avoid any possibility of fracturing the attachment lugs.
5. To ensure correct adjustment of the starboard tab the connecting screw (details B and C) must be screwed into the operating lever and the operating rod simultaneously.

6. After fitting a new elevator, the clearance between the elevator horn and the tail plane must be checked (fig. 12).
7. After fitting a new tab on the elevator, the clearance between the outboard end of the elevator must be checked (fig. 12).

Note . . .

A flight trim check must be made whenever an elevator or elevator tab is removed and replaced or adjusted (Sect. 3, Chap. 4, Appendix 1). ◀

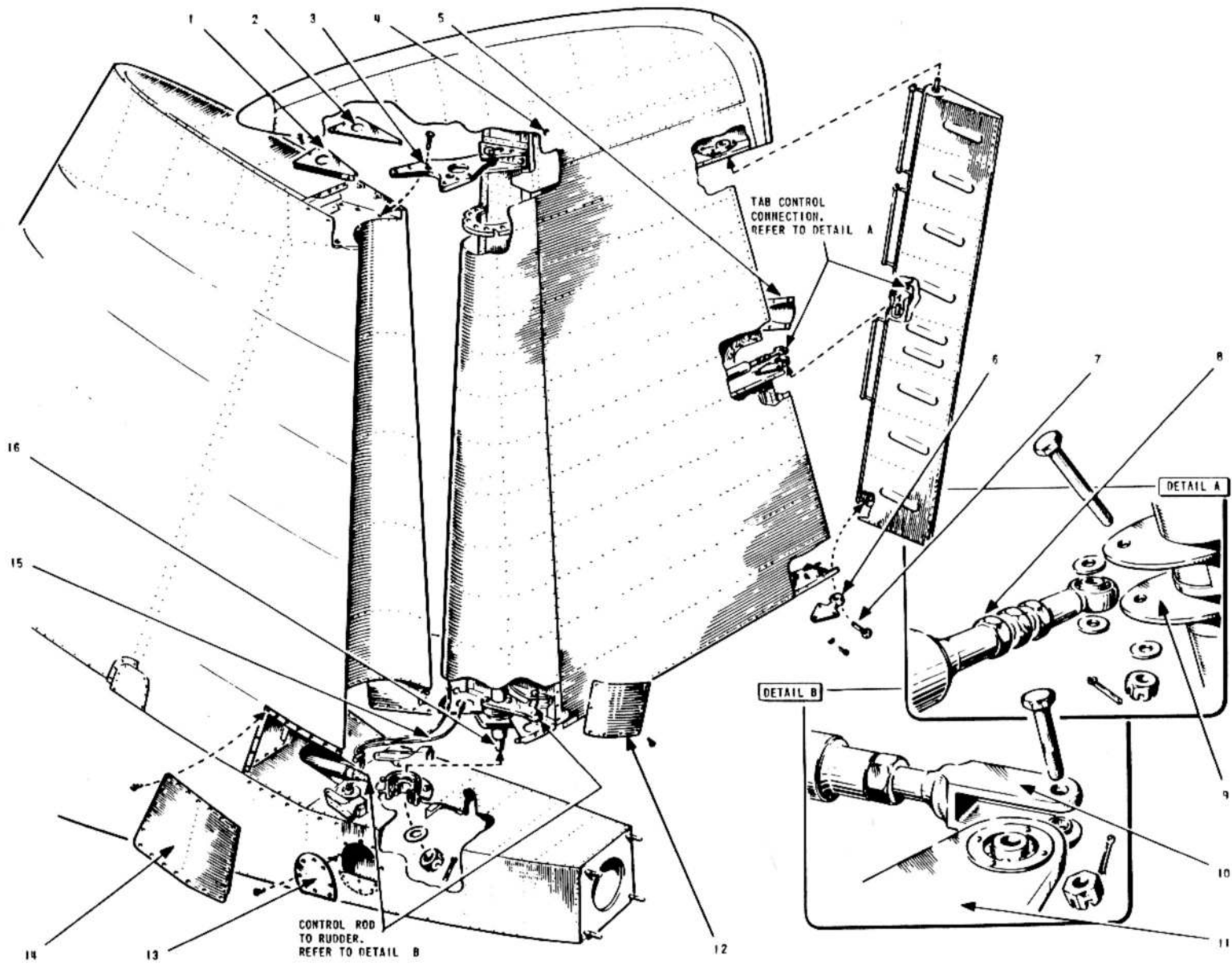


FIG.9. RUDDER AND RUDDER TAB REMOVAL

KEY TO FIG.9 (RUDDER AND RUDDER TAB REMOVAL)

To remove a rudder:-

(1) Screw a 4 B.A. bolt into the spring-loaded plugs (4) on the port and starboard sides of the rudder and remove the plugs by pulling the bolts outwards. Removal of these plugs permits a suitable sling to be passed through the rudder at this point.

(2) Remove the cover plates (12) at the base of the rudder, and the access panels (14) at the base of the fin.

(3) Disconnect the control rod (10) from the rudder lever (11) (*detail B*).

(4) Disconnect the electrical cables (15) from the rudder tab electrical actuator.

(5) Turn the rudder to port and remove the port closing plate (1).

(6) Turn the rudder to starboard and remove the starboard closing plate (2).

(7) Remove the circular access panel (13) on the port side of the rudder stub.

(8) Remove the split pin, nut and washer from the lower hinge (16).

(9) Turn the rudder to port and remove the three bolts from the port side of the upper hinge plate (3).

(10) Turn the rudder to starboard and remove the three bolts from the starboard side of the upper hinge plate (3).

The rudder is then free to be removed by lifting.

Note...

Care must be taken when lifting the rudder to ensure that the lower mass-balance weight does not foul the underside of the fin trailing edge.

Assembly notes...

Before assembling a rudder, ensure that the rudder lower hinge bearing (in the fuselage), is packed with grease (para.7A).

After assembling a rudder, check the following clearances:-

(1) Between the top of the fin and the rudder horn, this should be 0.30 ± 0.14 in.

(2) Between the base of the rudder and the rudder stub, this should be $0.40_{-0.05}^{+0.00}$ in.

(3) When fitting a new rudder, the 0.50 in. depth of either trailing edge spoiler may be reduced to suit the characteristic of individual aircraft.

Note...

The amount of spoiler strip remaining must not be less than 0.25 in.

If these clearances are not obtained, remove the shim Part No.EA1.12.201 between the rudder lower bearing housing and the stub, and replace it by a solid packing of the same overall dimensions and material (D.T.D.546) but of a thick-

ness between 0.056 in. (17 s.w.g.) and 0.104 in. (12 s.w.g.) as required.

To remove a rudder tab:-

(1) Remove the rudder tab control rod cowl (5).

(2) Remove the split pin, nut and washer from the bolt attaching the control rod (8) to the lugs (9) on the tab spar, and remove the bolt (*detail A*).

(3) Remove the three 2 B.A. bolts attaching the lower hinge bracket (6) to the rudder.

(4) Remove the tab from its hinges by lowering it slightly and moving it outwards.

Note...

If a new tab is to be fitted, remove and retain the hinge pin (7). Upon reassembly the hinge pin is to be locked with wire.

After fitting a new rudder tab, check the following clearances (*fig.12*):-

(1) Between the top of the tab and the rudder; this should be 0.17 ± 0.12 in.

(2) Between the bottom of the tab and the rudder stub; this should be $0.385_{-0.07}^{+0.08}$ in.

Note...

An additional axial tab movement of 0.02 in. in respect of these dimensions is permissible.

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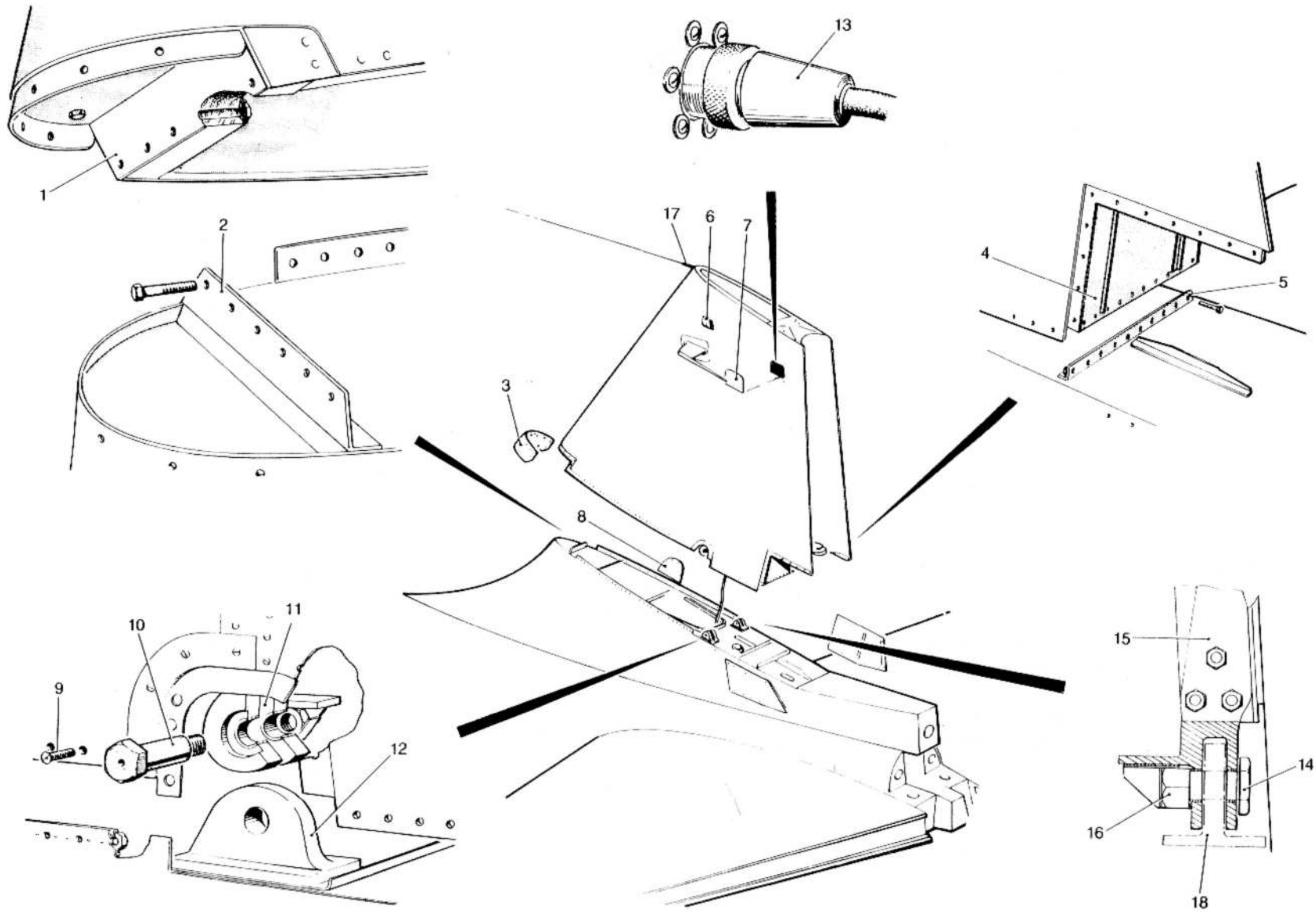


FIG.10 FIN-REMOVAL AND ASSEMBLY

◀ ITEM 17 ADDED ▶

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KEY TO FIG. 10 (FIN-REMOVAL AND ASSEMBLY)

To remove a fin:-

(1) Disconnect the H.F. aerial (17) from the fin (A.P.101B-0417-1B, Sect.8, Chap.2).

(2) Remove the rudder (fig.9).

(3) Remove the access panel (7) and disconnect the coaxial cable (13) to the A.R.I. aerial. Withdraw the cable from the aerial conduit.

(4) Remove the leading edge cover plate (3) and remove the six 2 B.A. bolts attaching the forward attachment former (1) to the stub angle piece (2).

(5) Remove the ten 2 B.A. bolts attaching the rear diaphragm (4) to the stub angle piece (5).

(6) Remove the one-hundred-and-two 2 B.A. countersunk bolts (9) attaching the fin skin to the skin of the fin stub.

(7) Remove the cover plates (8) from each side of the fin.

(8) Remove the port and starboard bolts (10) and (14) securing the fin post lugs (11) and (15) to the fin attachment lugs (12) and (18).

(9) Remove the fin.

Note...

The fin may be slung by removing the fabric patch (6) from each side of the fin and passing a sling through the fin at this point.

To assemble a fin:-

(1) Offer up the fin and insert the A.R.I. aerial coaxial cable (13) through the conduit. Connect the cable.

(2) Insert the port and starboard bolts (10) and (14). Do not tighten them.

(3) Secure the forward attachment former (1) to the stub angle piece (2) using the six 2 B.A. bolts.

Note...

When fitting a new fin it will be necessary at this stage to mark off

and remove the fin for drilling, dimpling and trimming.

(4) Secure the rear diaphragm (4) to the stub angle piece (5) using the ten 2 B.A. bolts.

(5) Secure the fin skin to the skin of the fin stub using the one-hundred-and-two 2 B.A. countersunk bolts (9).

(6) Screw home the port fin post lug attachment bolt (10). Do not over-tighten.

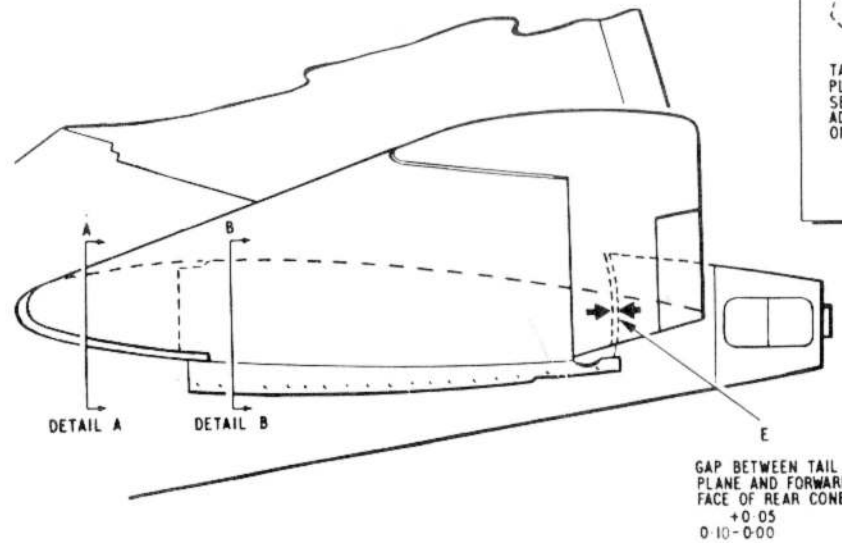
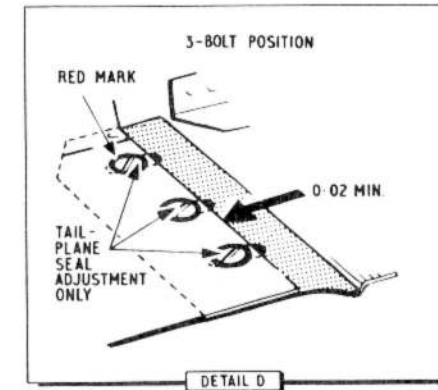
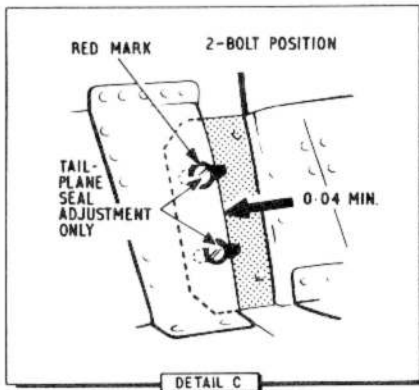
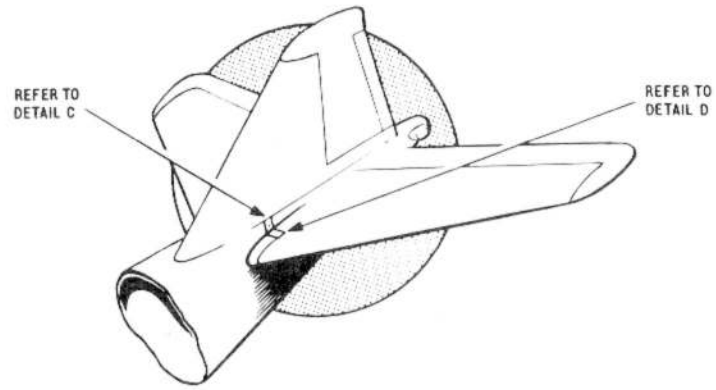
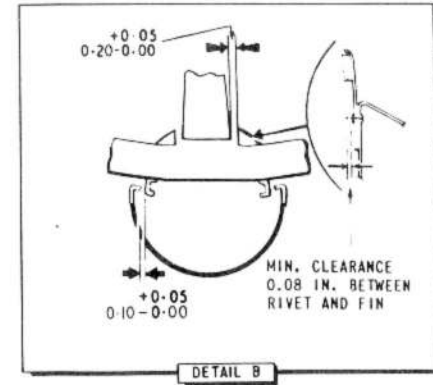
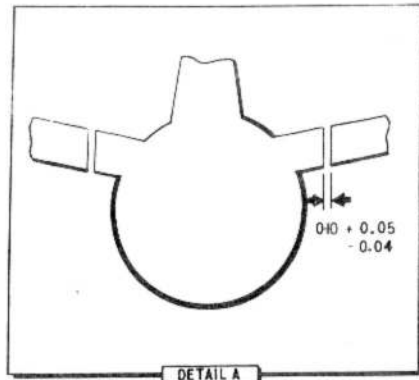
(7) Screw home the starboard fin post lug attachment bolt (14) to a point where the nut (16) is drawn against the inboard lug (18) of the fin post and obtain a clearance of 0.0015 in. between the head of the bolt and the lug.

(8) Fit the access panel and cover plates (3), (7) and (8).

(9) Fit the rudder (fig.9).

(10) Connect the H.F. aerial (17) to the fin (A.P.101B-0417-1B, Sect.8, Chap.2).

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NOTE... ALL DIMENSIONS ARE IN INCHES

FIG. II. TAIL-PLANE CLEARANCES

◀DETAIL DELETED▶

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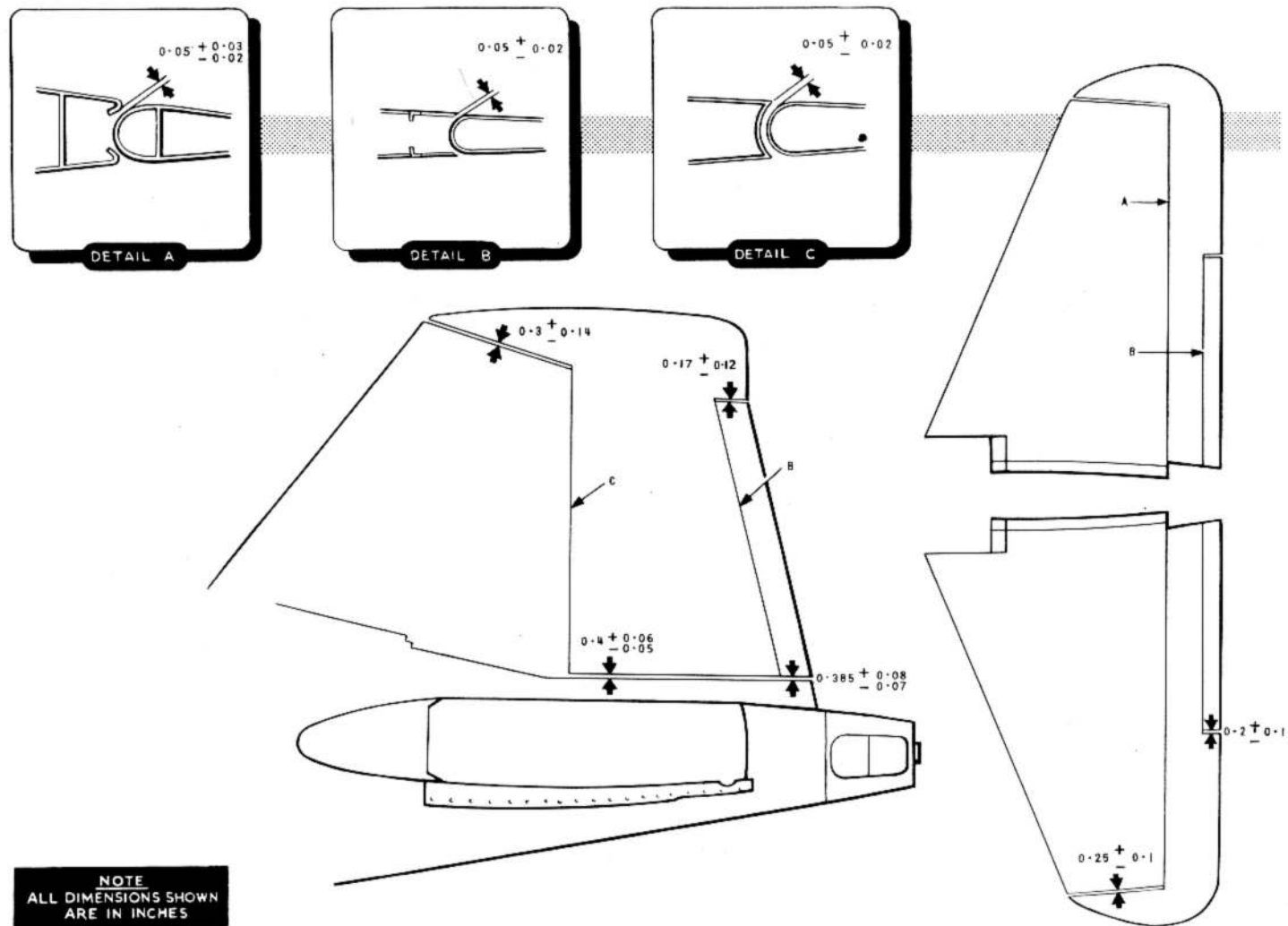


FIG. 12. FIN, RUDDER AND ELEVATOR CLEARANCES

Chapter 4 FLYING CONTROLS

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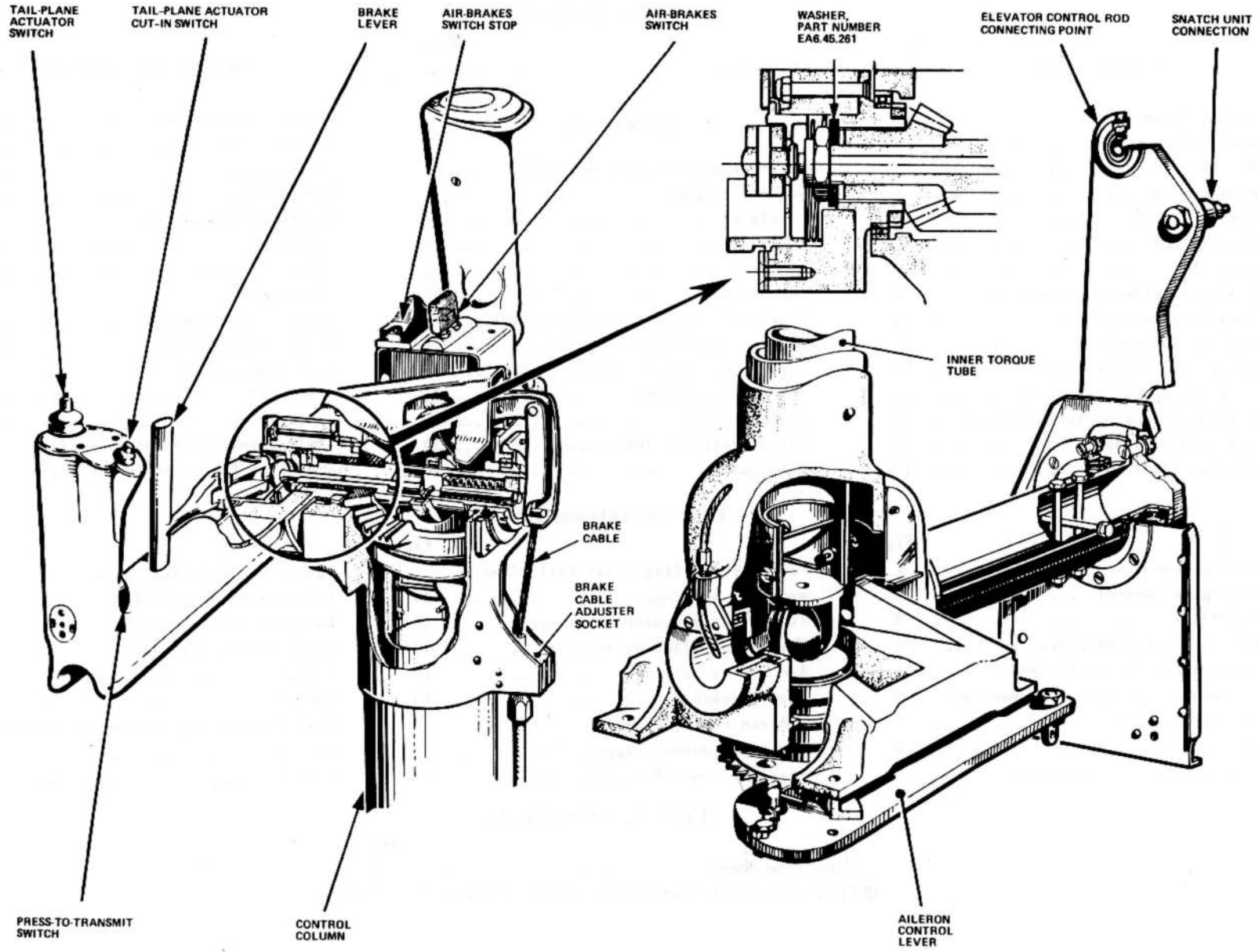
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FIG. 1. CONTROL COLUMN

DESCRIPTION

General information

1. The flying controls are conventional in operation, the control runs consisting of push-pull rods and levers, with adjustable ends fitted to the rods on each control run. Tabs in the trailing edges of the ailerons, port elevator, and rudder, are operated automatically through torque tubes and blow-back rods incorporated in the structure of the control surfaces. The starboard elevator tab operates as a balance tab, and can be set only on the ground. Trim strips are fitted to the trailing edges of the elevators and these are adjusted to the specifications in the Appendix of this chapter. The upper trailing edge of the rudder is fitted with spoilers which are adjustable to suit the characteristics of individual aircraft (they are preset by the manufacturer and should not normally require alteration). Each aileron is fitted with a fixed trim strip which can be adjusted on the ground as detailed in the key to fig. 15. An electrical control permits the rudder tab to be used additionally as a trim tab in flight. Trim tabs are not fitted to the ailerons, but aileron bias is provided which is effected electrically by a bias actuator mounted beneath the pilot's floor. The variable incidence tail plane is electrically actuated and controlled; the flaps and air-brakes are also electrically controlled, but are hydraulically operated.

Control column (fig.1)

2. The control column, situated on the port side of the cabin centre line, is

a tubular member which moves fore-and-aft on its support housing under the cabin floor. At this housing it is coupled with a tubular shaft running laterally outboard to a bracket on the port side: a lever attached to the end of this shaft is connected to the elevator control run. Forward of this lever, and on the same shaft, is a shorter lever connected to the snatch rod of the snatch unit (Sect.3, Chap.11). At its upper end the control column carries a horn-type control wheel, the shaft of which passes into the interior of the column where a bevel gear, integral with the shaft, meshes with a toothed segment at the top of the torque tube contained within the control column. The torque tube is supported in a bearing at the upper end of the column, and terminates at its lower end in a universal joint, which links it with a short shaft carried in the support casting; a lever at the end of this shaft is connected with the aileron control run. Mounted on the control hand wheel are the wheel brakes operating lever, the air brakes selector switch, and various other switches (fig.1).

Rudder bar

3. The rudder pedals are fitted at each end of a centrally-pivoted horizontal cross-tube, and are fitted with alignment linkage giving them parallel fore-and-aft movement. The cross-tube is attached to a short vertical torque tube which protrudes through the pilot's floor, and is linked to an adjusting screw mechanism by which the pedals can be set to suit the pilot's leg reach. Movement of the rudder pedals is trans-

mitted via the torque tube and a horizontal lever at the bottom of the tube, to a push-pull rudder control rod. Attached to this horizontal lever is a connecting rod to the brake relay control valve, which controls differential braking (Chap.6). The movement of the rudder pedals is limited by two adjustable stops in the pressure box on the pressure bulkhead acting on the main operating lever (fig.3).

Aileron control

4. Movement of the ailerons is controlled by the control column hand wheel, which rotates the inner torque tube of the control column; the aileron control lever at its lower end converts the rotary movement into a fore-and-aft movement which is transmitted to the ailerons by push-pull rods and levers. Attached by a tension spring to the aileron lever at the control column base is the bias actuator (para.9). From the aileron control lever at the base of the control column the control passes aft along the port side of the cabin to the inboard one of three levers mounted in the pressure box just aft of the pressure bulkhead. The control run continues from this lever through the port equipment compartment and along the electronic equipment bay roof to just aft of the main spar where, via a bell-crank lever, the controls enter the main planes. Here further bell-crank levers connect the control tubes to the aileron levers. The control tubes are carried along the fuselage by roller guides and are supported in the main planes by the bell-crank and aileron levers. Adjustable stops (fig.3) within

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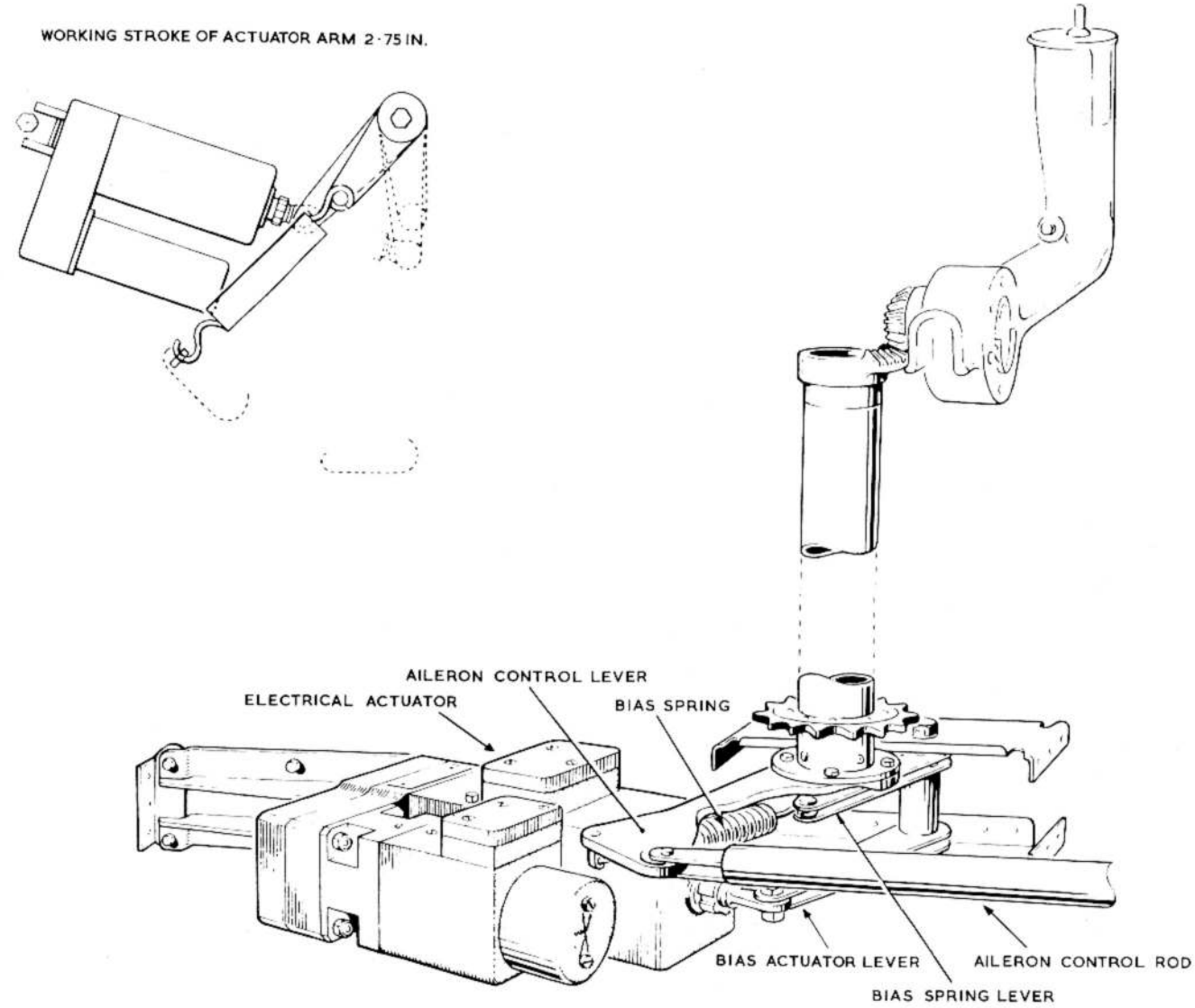
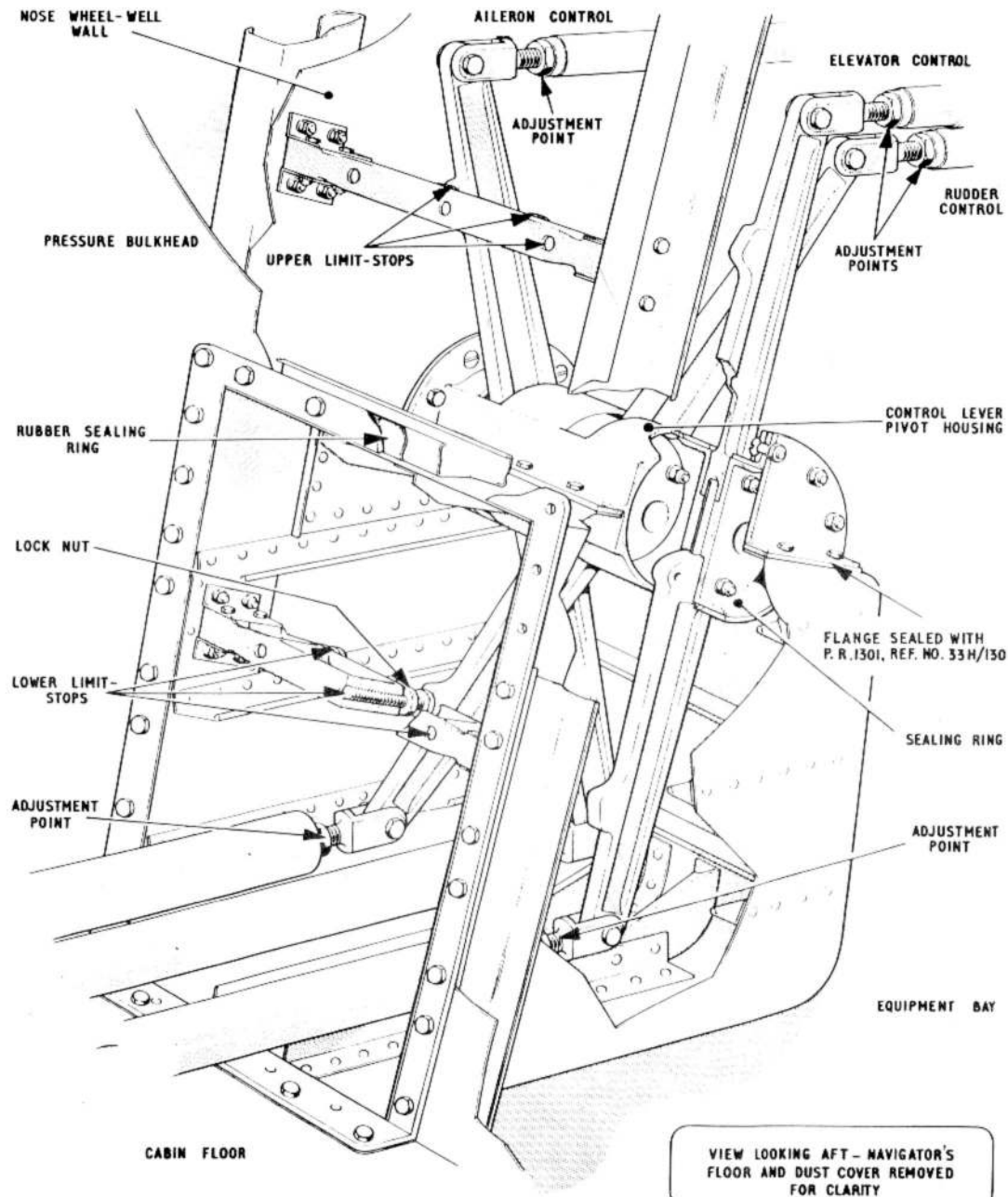


FIG.2. AILERON BIAS CONTROL

◀ MINOR ANNOTATION AMENDMENT ▶

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Fig. 3. Pressure box

the pressure box on the pressure bulkhead in line with the aileron lever limit hand-wheel movement. Control surface movement is limited by stops at the aileron inboard hinges.

Elevator control

5. The elevators are controlled by fore-and-aft movement of the control column, this movement being transmitted, by a lever attached to the outboard end of the lateral tube at the bottom of the control column, to the port elevator by push-pull rods and levers. From this control lever, the control rod passes aft, along the port side of the cabin, to a lever mounted at frame 6 which reverses its movement, then on to the outboard one of the three levers mounted in the pressure box just aft of the pressure bulkhead. The control continues from this lever through the equipment compartment, along the roof of the electronic equipment bay and through the rear fuselage, to a lever on the bulkhead at frame 42. The port elevator lever is connected to the lever by a further control rod, and the elevators are connected together by a coupling link joining the levers on the inboard ends of both elevator spars. The control rods are carried in Fairey roller guides positioned in the fuselage structure, and are provided with couplings at the fuselage transport joint positions. Adjustable stops, located at the pressure box on the pressure bulkhead in line with the elevator lever, limit control column movement, and adjustable control surface limit stops are provided at the starboard elevator link lever.

Rudder control

6. The rudder is controlled by movement of the rudder pedals, this movement being transmitted to the rudder by a horizontal lever at the bottom of the rudder torque shaft, and push-pull rods and levers. From the rudder torque tube lever, the control rod passes aft along the port side of the cabin, to the centre one of the three levers mounted in the pressure box just aft of the pressure bulkhead. The control run continues from the pressure box lever through the equipment compartment, along the roof of the electronic equipment bay and through the rear fuselage to the lower end of a lever on the bulkhead at frame 42. From the opposite end of this lever, a further control rod is connected to a lever at the bottom of the rudder. The control rods are carried in Fairey roller guides, positioned in the aircraft structure, and are provided with couplings at the fuselage transport joint positions. Adjustable stops located at the pressure box on the pressure bulkhead in line with the rudder lever, limit rudder bar movement. Rudder movement is limited by rubber stops at its lower hinge.

Pressure box (fig.3)

7. The point at which the flying controls pass through the pressure bulkhead is called the pressure box. The box is of reinforced alloy construction and is bolted, over a rubber pressure seal, to the pressure bulkhead. On entering the pressure box from the cabin the flying control rods are connected to the lower attachment points of individual, centrally-pivoted levers, which are

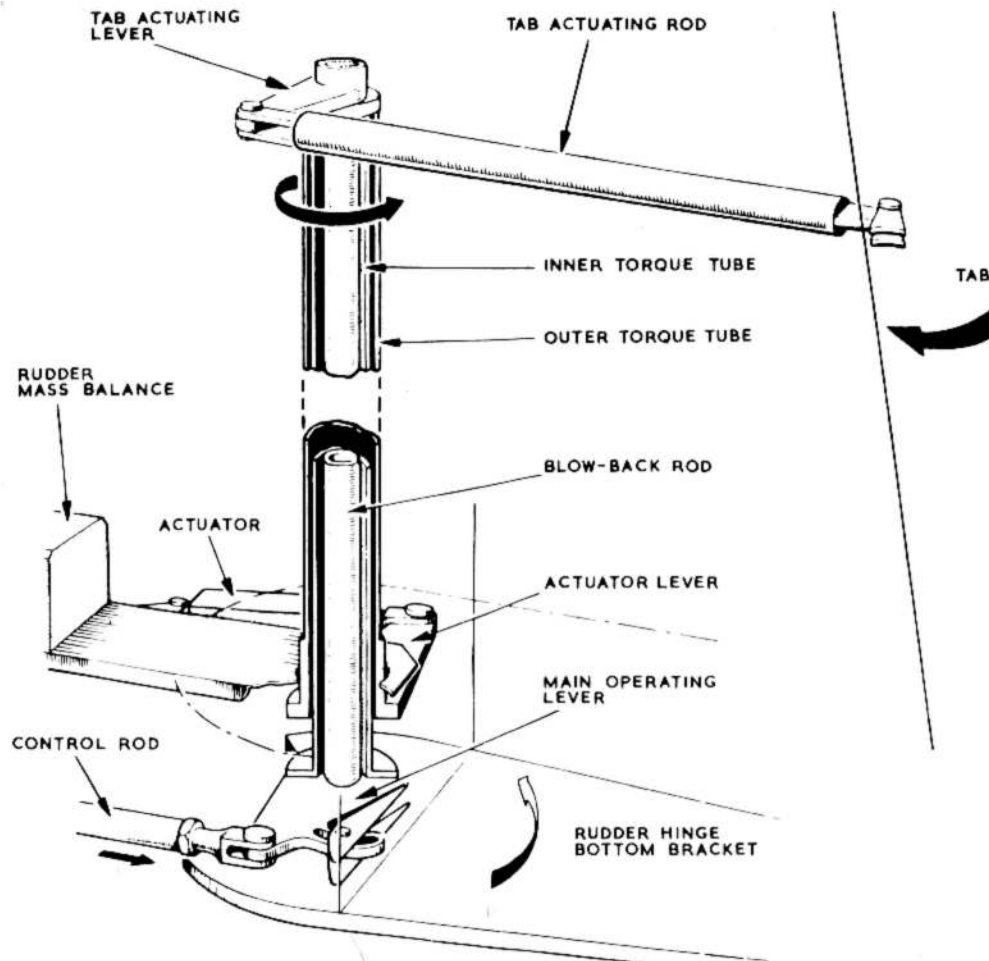


Fig.4 Rudder spring tab mechanism

◀ ANNOTATIONS AMENDED ▶

pressure sealed about their pivot points. The upper portions of the three levers are connected to the control rods which continue through the port equipment compartment. Stop-bolts, mounted on two channel section members, act on the levers in the pressure box and limit the movement of the pilot's controls; these stops are adjustable, and the correct dimensions and method of setting are given in the associated control rigging diagram and key.

Tail plane incidence control

8. The variable-incidence tail plane is hinged at its main spar centre section on two brackets attached to the rear fuselage at frame 42; at its false spar, near the trailing edge, it is connected to the rear fuselage by an electrical actuator. The actuator, which is controlled by a three-position switch on the right handgrip of the control column hand wheel (*fig.1*), forms a strut between the tail plane and fuselage, the length of which may be varied in flight under the control of the pilot; extension of the actuator decreases the tail plane incidence. A cut-in switch mounted on the same handgrip has to be depressed to make electrical power available to the actuator.

Aileron bias control (*fig.2*)

9. Aileron trim is effected by a bias gear connected to the aileron control lever at the lower end of the control column, there being no independent aileron trim tab. The gear is operated by an electrical actuator which is attached at one end to a floor member, and at the other to a bias actuator

lever pivoted on a floor member adjacent to the control column. A bias spring lever, integral with the bias actuator lever, is connected to the aileron control lever at the lower end of the control column by a tension spring. The relationship of the two levers is such that when the actuator is at its mid position, i.e. half extended, the spring is at its minimum tension when the control hand wheel is at neutral, and an equal load will be applied to the control when the hand wheel is moved to port or starboard. Operation of the actuator, either in or out, will increase the effect of the spring in one direction and decrease it in the other, and bias the control accordingly. The actuator is controlled by a spring-loaded centre-off position switch on the pilot's console, and an aileron trim indicator, operated by the movement of the actuator, is mounted on the instrument-flying panel.

Spring tab mechanisms

10. The rudder, port elevator, and both ailerons are fitted with spring tabs complete with blow-back rod and torque tube mechanisms, which, in addition to their normal function when operated by the flying controls, have an entirely separate automatic operation. Their normal function is to relieve the pilot of heavy physical loads on the controls, such as would be occasioned by major changes of direction at high speed; their automatic operation prevents the application of excessive control surface movement. With the exception of the rudder mechanism, which is fitted with two concentric torque tubes and

has, in addition, electrical trim actuation, the mechanisms differ only in size. The double torque tubes on the rudder mechanism act as one tube, but as they tend to make it appear slightly more complicated than those fitted for the aileron and elevator tabs, the rudder mechanism is described in full. The description however, is equally applicable to all three.

Rudder spring tab mechanism (*fig.4*)

11. During normal flight the electrical actuator acts as a strut with fixed centres anchoring the actuator lever to the rudder structure through the mass-balance arm. The actuator's function when used as a strut with variable pin centres is described in para.16.

12. In a normal turn to starboard, the pilot pushes the starboard rudder pedal and the control rod moves aft, rotating the rudder main operating lever in a counter-clockwise direction. The torque applied by the main operating lever is transmitted through the inner and outer torque tubes to the actuator lever which, through the actuator, moves the rudder over to starboard. Assuming that there is no air load on the rudder and that the rudder hinges are frictionless, the actuator lever and consequently the rudder will rotate through the same angle as the main operating lever. During flight, the air load on the rudder resists rudder rotation, and since the torque tubes are torsion springs, they twist under the pilot's effort; consequently the main operating lever moves through a greater angle than the actuator lever and the rudder.

The main operating lever has now rotated in a counter-clockwise direction relative to the rudder, as has also the tab-actuating lever, due to the rotation of the blow-back rod which, at its lower end, is attached to the main operating lever. This rotation of the tab-actuating lever is transmitted to the tab by the tab-actuating rod and moves the tab to port; the air load on the tab then moves the rudder to starboard.

13. In addition to its function as a driving shaft between the main operating lever and the tab-actuating lever, the blow-back rod has a safety role. The maximum movements of the rudder and tab, as regulated by their stops, are required for control at low speeds. If it were possible for the pilot to move the rudder through these maximum angles at high speed, prohibitive loads would be imposed on the aircraft structure. In flight, the angle of the rudder is determined by the angle of the tab, so that by restricting the tab movement during high speeds excessive loads on the structure are avoided. This restriction of tab movement is imposed by the blow-back rod which, under the influence of the high air load imposed by the application of large tab angles at high speed, twists in the direction opposite to that applied by the pilot to the main operating lever, with consequent reduction of tab and rudder angles. A stop-bolt, attached to the rudder spar, operates in a slot in the main operating lever in order to prevent the pilot applying excessive twist to the torque tubes. In flight, when the main operating lever is moved relative to

the rudder and so moves the tab, one end of the slot momentarily approaches the stop-bolt but the applied tab causes the rudder to turn in the same direction as the main operating lever, and the bolt moves away from the end of the slot.

Aileron spring tab mechanism (fig.5)

14. The spring tab blow-back rod and torque tube mechanism is mounted laterally, forward of the aileron spar. The operation of the mechanism is similar to that of the rudder spring tab (para.11-13).

Port elevator spring tab mechanism (fig.6)

15. The spring tab blow-back rod and torque tube mechanism is mounted laterally, aft of the port elevator spar. The operation of the mechanism is similar to that of the rudder spring tab (para.11-13).

Rudder trim actuator

16. The rudder trim tab actuator forms a strut between the outer torque tube of the spring tab mechanism and the

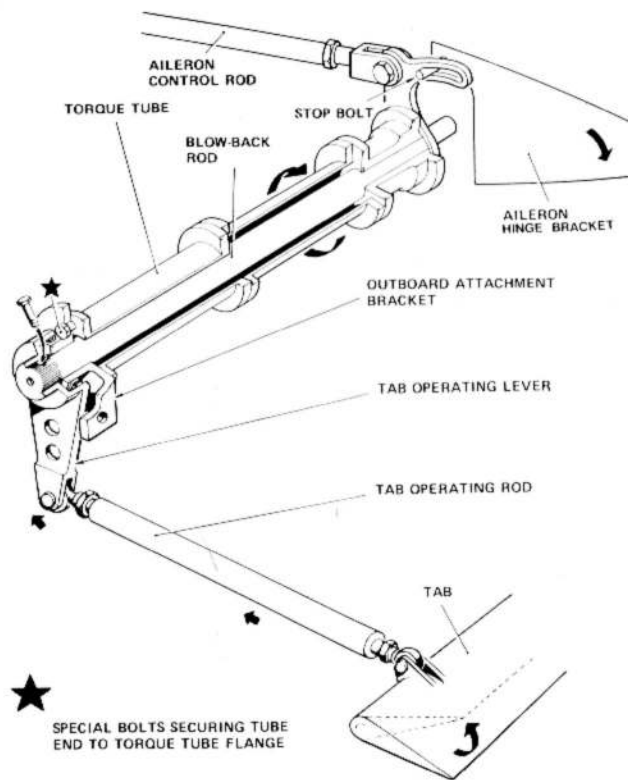


Fig.5. Aileron spring tab mechanism

◀ Torque tube redrawn ▶

mass-balance arm at the base of the rudder. Operation of the actuator alters the position of the spring tab mechanism relative to the rudder, and moves the rudder tab to an angle corresponding to the rudder angle required, thus enabling the aircraft to be flown without applying any load at the rudder bar. The actuator switch is located on the pilot's

console and a rudder trim indicator is mounted on the instrument-flying panel.

Air-brakes control (fig.7)

17. Three-position air brakes, consisting of 21 finger-type drag channels, are installed in each main plane outboard of the engines and aft of the main spar. They are operated by a single

hydraulic jack in each main plane and are controlled electrically by a switch on the top of the control column. The three-way switch has a centre lock; a slide stop adjacent to the switch, prevents inadvertent selection to the full OUT position. In the out and mid positions nine of the drag channels protrude through the upper skin surface, and twelve through the lower skin surface of each plane. The limits of travel are governed by a cam on the starboard jack piston-rod and two microswitches attached to the body of the jack, which control a solenoid-operated valve in the circuit. The air brake mechanism is described in Sect. 3, Chap. 2, and the hydraulic circuit in Sect. 3, Chap. 6.

Flaps control (fig.8)

18. The flaps are operated by four double-ended hydraulic jacks, one jack to each flap. They are controlled electrically by a selector switch mounted on the alighting gear sloping panel.

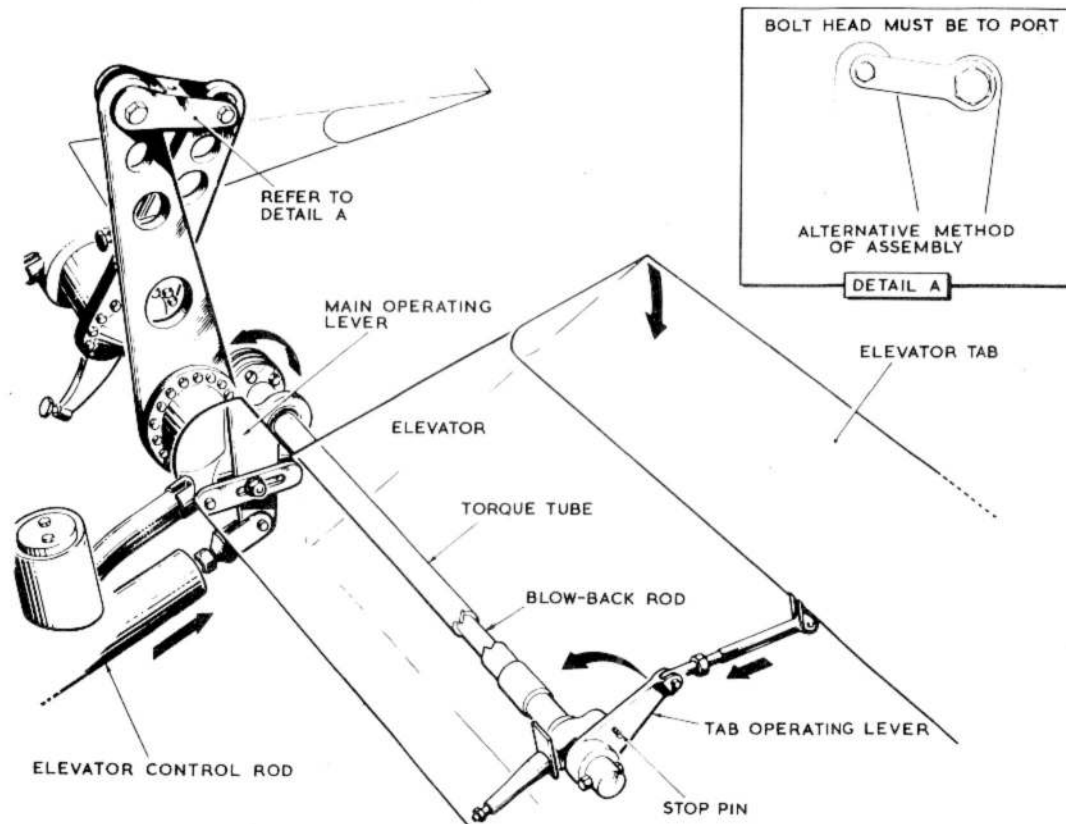


Fig. 6 Port elevator spring tab mechanism
◀ Torque tube and blow-back rod amended ▶

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

Controls neutral rigging locks (fig.9)

19. Three neutral rigging locks are provided for use when rigging the flying controls. They are: -

Aileron lock

The lock is clamped to the control column so that the lock horns contact the underside of the hand wheel.

Elevator lock

The lock is clamped to the control column and an adjustable tie-rod terminating in a spade end, passes through the engine

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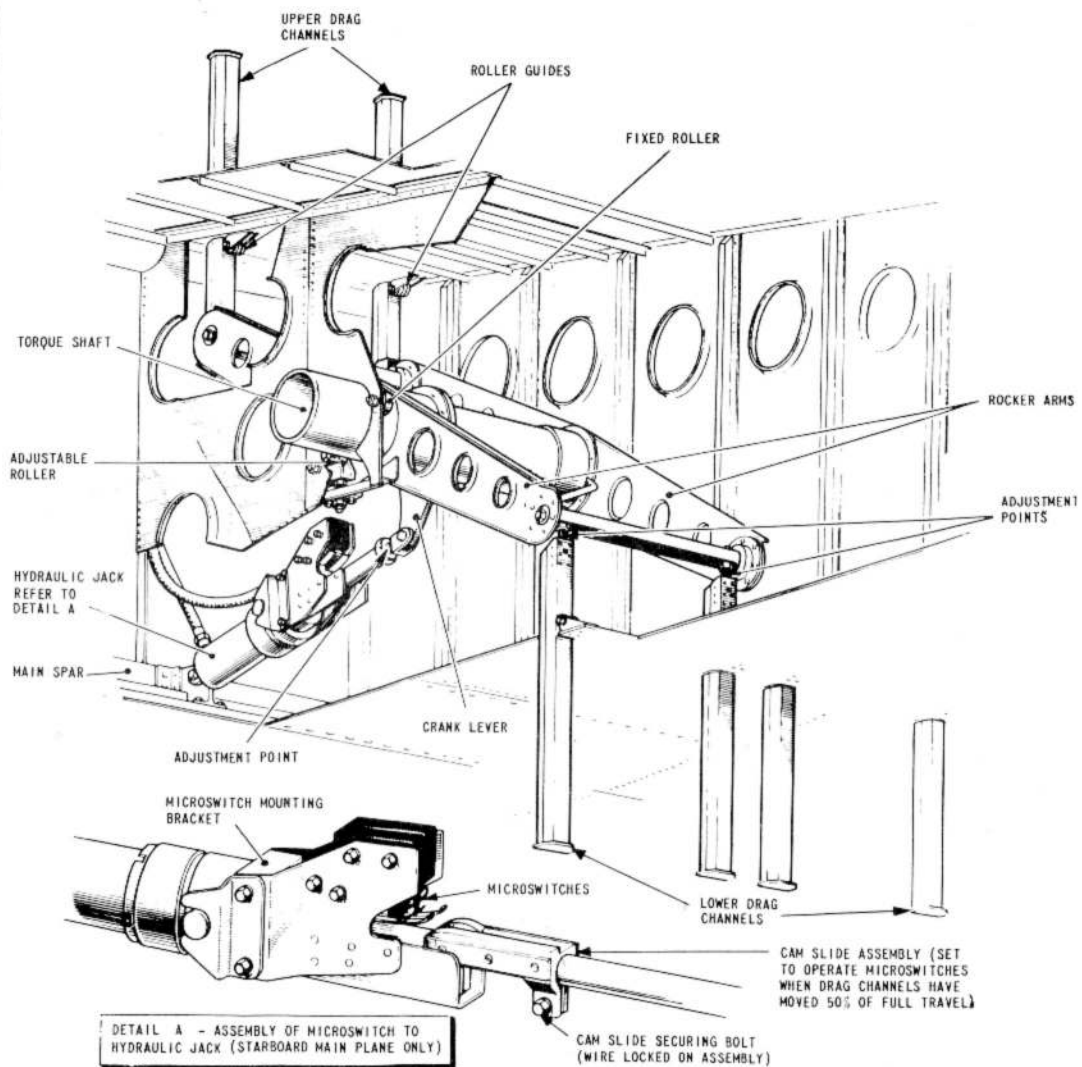
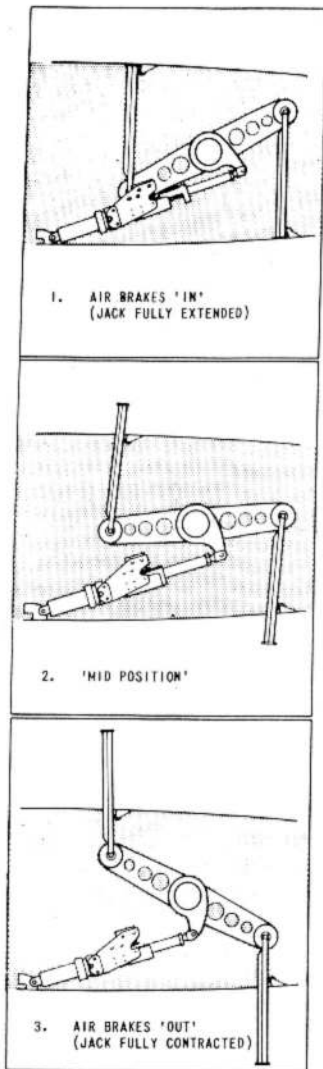


FIG.7. AIR BRAKES CONTROL

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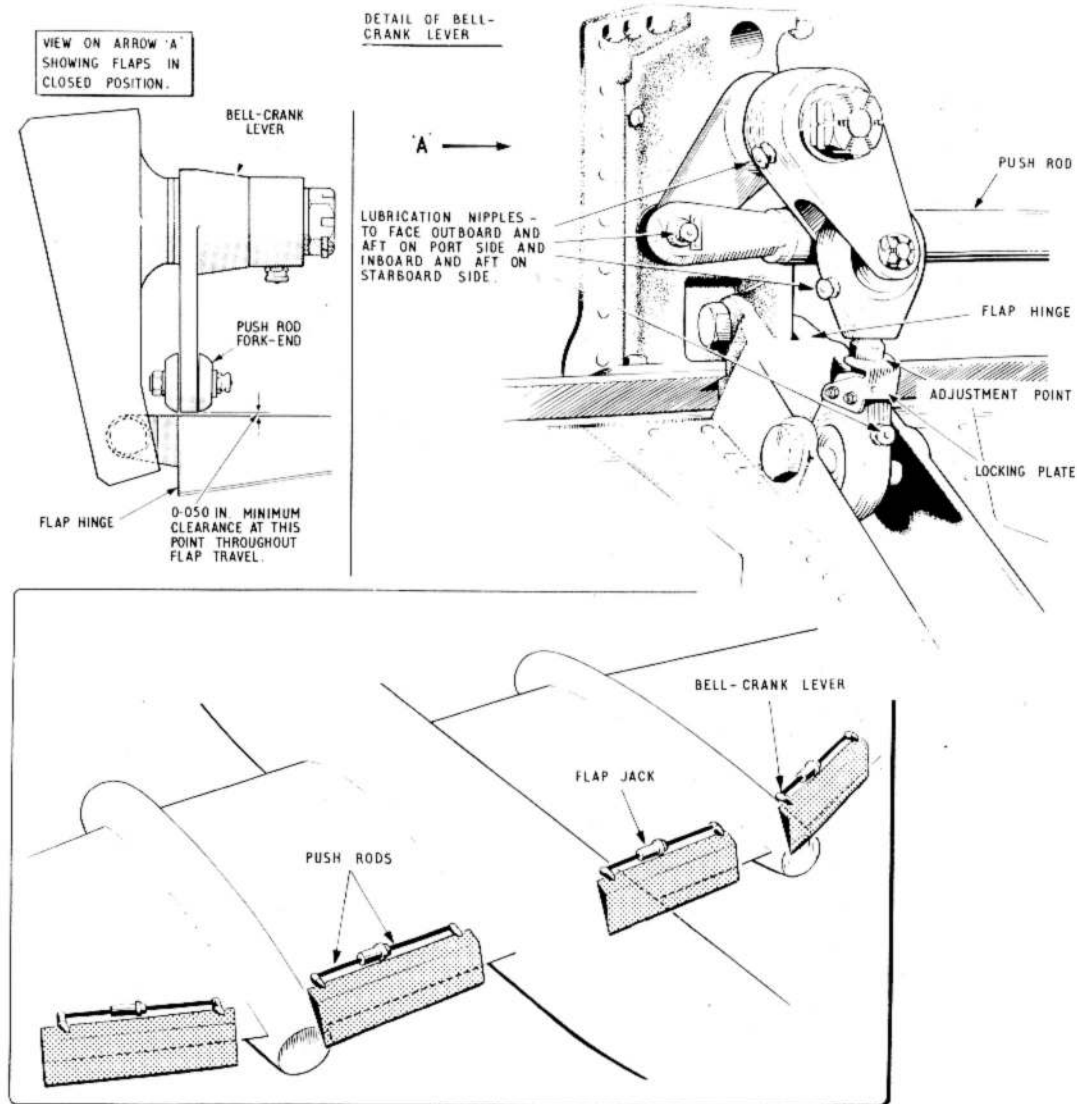


Fig.8. Flaps control

◀ Locking plate bolts reversed ▶

starting panel and is locked in position by a quick-release pin.

Rudder lock

The lock fits over the rudder bar star-wheel spindle and is secured to the pilot's floor by four bolts. The front plate of the lock fits hard against the starwheel, which is prevented from rotating by two bolts protruding through the plate.

Control rigging

Aileron

20. Refer to fig.15.

Elevator

21. Refer to fig.16 and 16A.

Rudder

22. Refer to fig.17.

Aileron bias

23. No adjustment is provided in the aileron bias mechanism. The actuator pin centre distance is set by the manufacturers and does not need further adjustment.

Starboard elevator ground-set tab

24. To adjust the starboard elevator ground-set tab:-

(1) Lock the elevator in its neutral position by clamping the elevator horn to the tail plane.

(2) Remove the elevator tab control access panel on the upper surface of the elevator.

(3) Slacken the locknuts on the ad-

juster between the tab connecting rod and the end piece.

(4) Operate the adjuster until the tab chord line is 2 deg 21 min up relative to the elevator chord (linear dimension, 0.25 in. \pm 0.05 in. between the trailing edges of the elevator and tab, measured at the outboard end of the tab). Relock the adjuster locknuts.

(5) Remove the lock fitted in operation (1), move the elevator through its full travel in both directions and check the tab movement; it should be 17 deg 30 min with the elevator up or down (linear dimension 1.85 in. \pm 0.1 in. measured as in operation (4)).

Rudder trim actuator setting

25. The rudder trim actuator electrical stops are set to give a working stroke of 2.72 in. and the pin centres are nominally set at 7.5 in. (fully contracted) against an electrical stop. The mechanical stops are set to give a working stroke of 3 in. and the pin centres are nominally set at 7.425 in. (fully contracted) against a mechanical stop. These are manufacturer's settings and should not require any adjustment; however, the pin-centres may be adjusted \pm 0.125 in. as follows:-

(1) Remove the actuator (*para. 40*).

(2) Using an 18-volt electrical supply, extend the actuator until the 1/16 in. dia. hole in the actuator arm is visible.

(3) Slacken the locknut securing the fork-end and screw the fork-end either inwards or outwards to adjust.

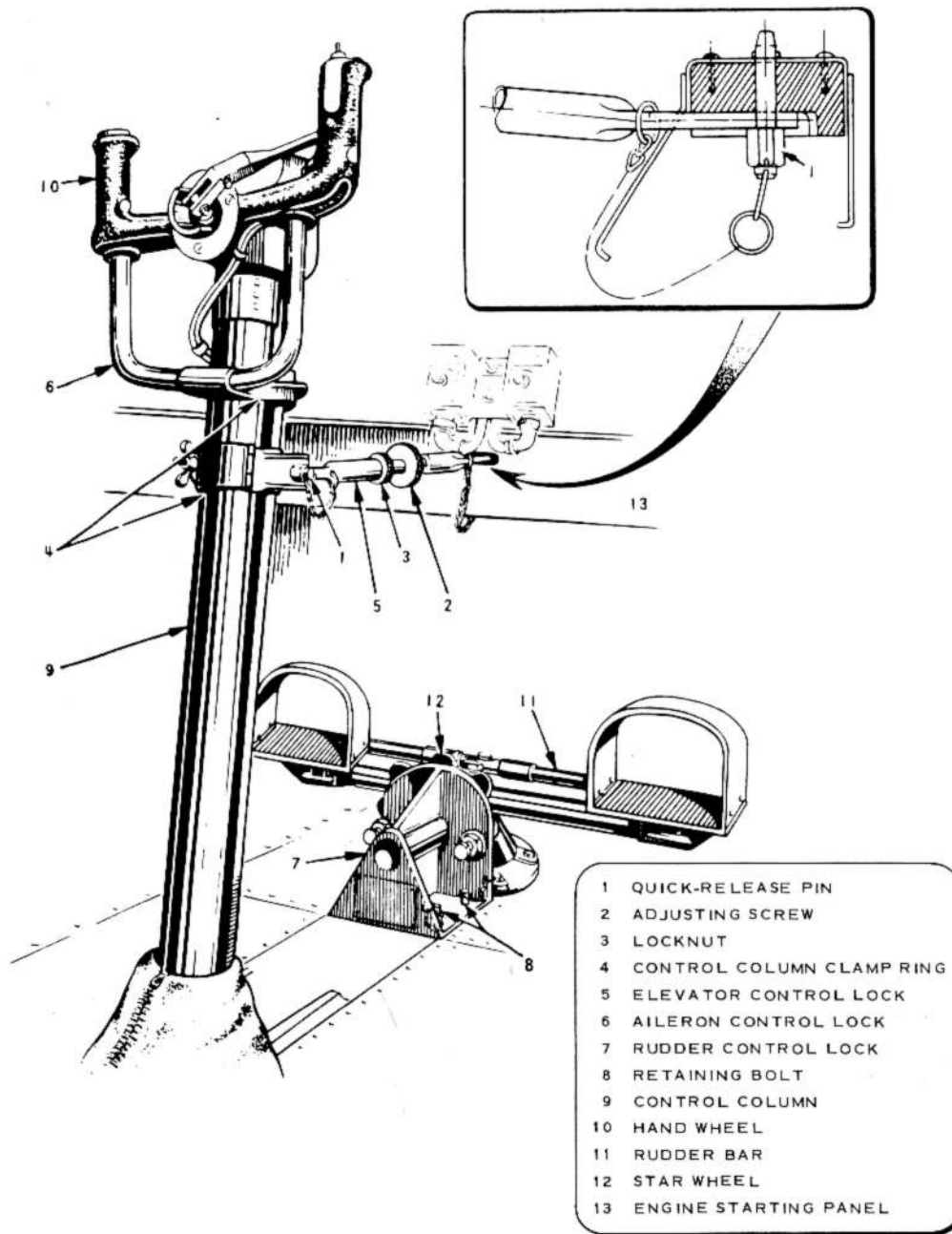


Fig. 9. Control neutral rigging locks

(4) After adjustment, insert a piece of 1/16 in. dia. wire into the hole in the actuator arm. If the penetration is greater than 1/16 in. too much outward adjustment has been made and the fork-end must be screwed inward.

(5) Tighten the locknut securing the fork-end.

(6) Using an 18-volt electrical supply, check that the electrical stops operate

when the pin-centres are 7.5 in. and 10.22 in.

(7) Replace the actuator in the reverse order of removal.

26. To check the movement of the rudder tab and actuator:-

(1) Connect a ground electrical supply at the ground supply socket and, in the case of aircraft not incorporating Mod.

258, place the GROUND FLIGHT switch at GROUND.

(2) With the rudder in line with the fin and the tab in line with the rudder, operate the actuator until the pin-centres are 9.42 in., and check that the tab is moved 18 deg to starboard (linear dimension $1.73^{+0}_{-0.1}$ in. measured from the inboard trailing edge of the tab to the normal centre line of the rudder).

(3) Retract the actuator to obtain pin-centres of 8.37 in., and check that the tab is moved 18 deg to port (linear dimension $1.73^{+0}_{-0.1}$ in. measured as in operation (2)).

Note...

1. The excess of working stroke over the amount required to give full tab movement, is provided to cater for deflection of the torque tube and blow-back rod when an air load is applied to the tab.

2. If the rudder tab movement is in excess of 18 deg, a new rudder tab actuating lever stop plate Ref.No. 26FZ/5495 (fig.21) should be fitted, and the stop faces filed, if necessary, to obtain the desired 18 deg movement. Similarly, if the 18 deg movement is unobtainable, the existing stop plate may be filed. Protective treatment (A.P.119A-0509-1) must be applied to all filed surfaces.

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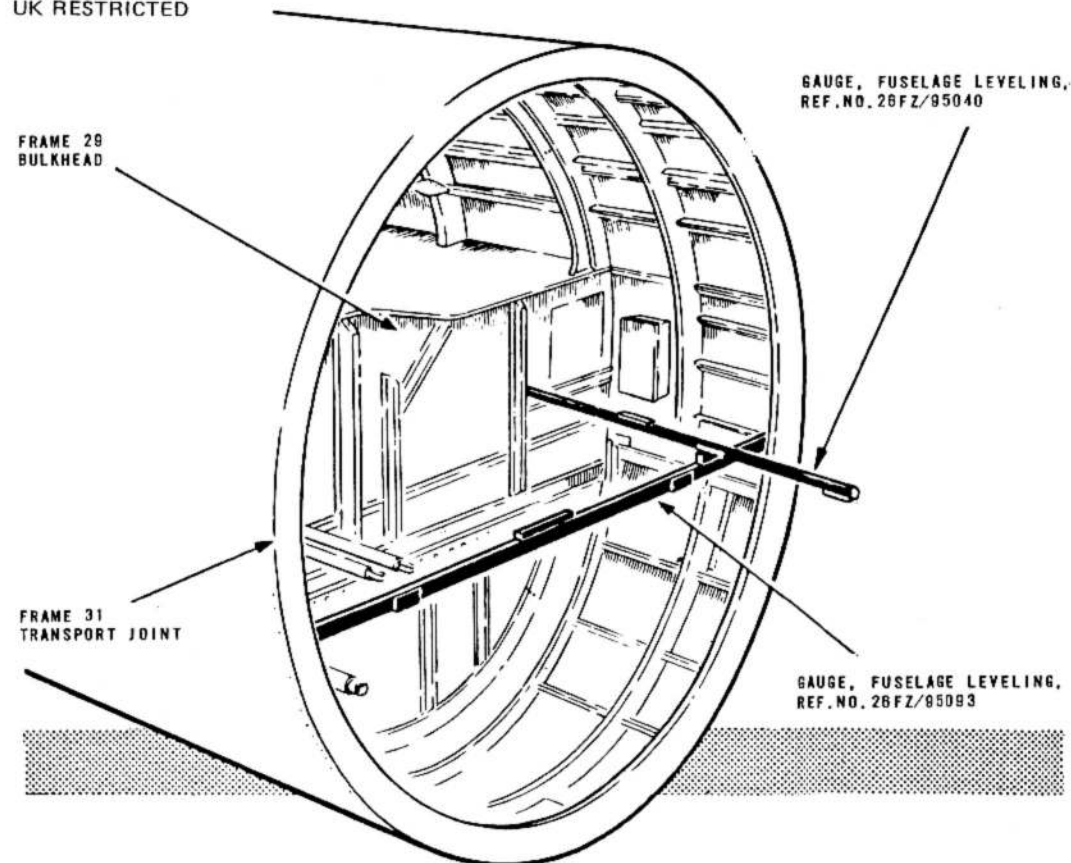


Fig. 10. Fuselage leveling - for tail plane actuator setting

Tail plane actuator setting

27. The following instructions for the setting of the tail plane actuator are

listed in the sequence in which the setting must be carried out.

Note...

All tail plane angles are to be measured on the starboard tail plane at the inboard rigging board position, using incidence gauge Ref.No.26FZ/95115 relative to the fuselage horizontal datum. The clinometer should not be disturbed during the rigging operations and readings should be related to its initial setting.

(1) Jack and trestle the aircraft (Sect.2, Chap.4).

(2) Open the camera access hatch and place lateral leveling gauge Ref.No. 26FZ/95093 on the leveling brackets, port and starboard, at frame 31. The port and starboard ends are indicated on the gauge (fig.10).

(3) Level the aircraft laterally ($0 \text{ deg} \pm 0 \text{ min}$).

Note...

It is most important that the aircraft is rigged to this degree of accuracy - both laterally and longitudinally - otherwise any deviation will have to be allowed for in the subsequent tail-plane settings.

(4) With the lateral gauge in position, place longitudinal gauge Ref.No.26FZ/95040 on the leveling bracket on the starboard side of frame 29 bulkhead, and on the datum pad on the lateral gauge (fig.10).

(5) Level the aircraft longitudinally ($0 \text{ deg} \pm 0 \text{ min}$).

(6) Ensure that the microswitch tappets are screwed fully home, and that the upper and lower microswitches are set to give the minimum distance between the switches and tappets (fig.12).

(7) Retract the actuator on to its mechanical down stop and check that the tail plane up travel limit - tail plane leading edge up - is $4 \text{ deg } 7 \text{ min} \pm 4 \text{ min}$ relative to the fuselage datum (fig.11).

Note...

As a precaution against damaging the actuator when running it on to its

down stop, it is advisable to operate the motor in that direction at a reduced voltage. This is achieved by disconnecting the cable core T33L-1 (circuit C21) from the terminal A1 on the low-speed motor reversing relay in the rear fuselage, and then connecting a resistor of approximately 2.2 ohms resistance and 200 watt rating between the cable terminal and the relay terminal A1. A suitable resistor would be a Painton Type 5007, of approximately 2.2 ohms resistance, and 'B' termination.

(8) Insert a 1/16 in. dia. pin in the actuator ram safety hole and check that it does not penetrate to a depth exceed-

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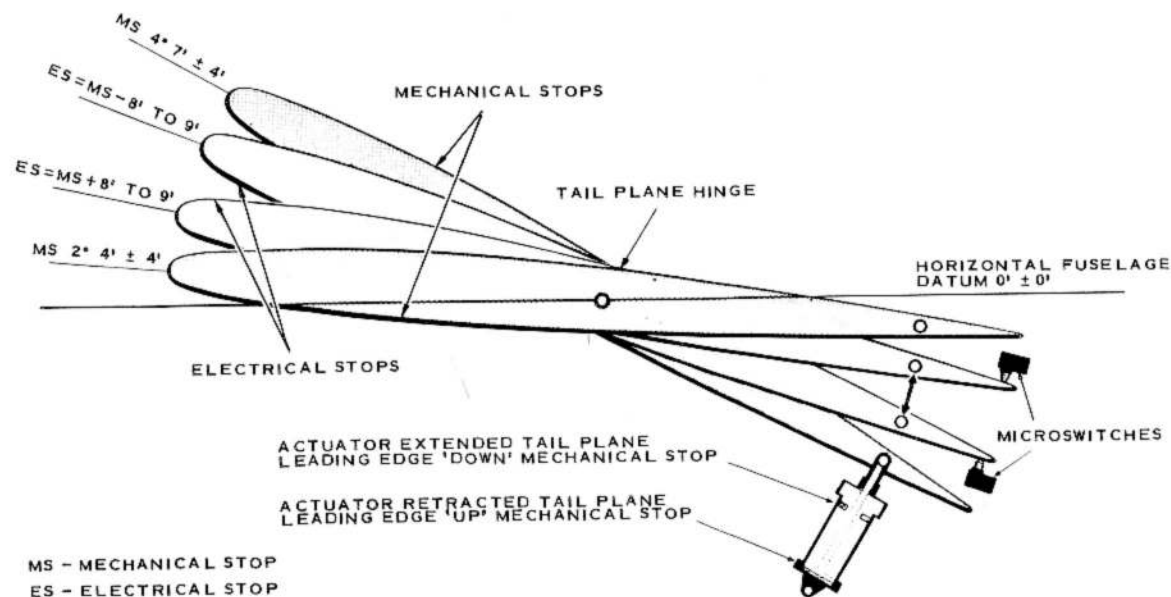
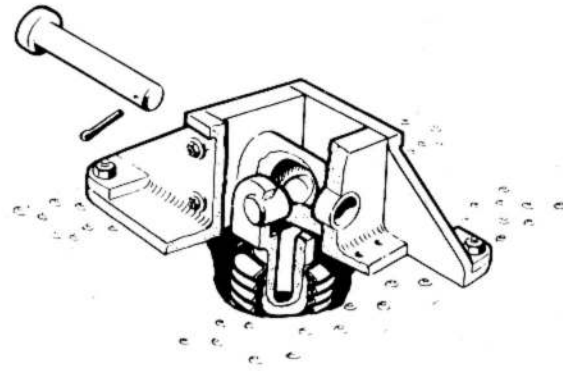
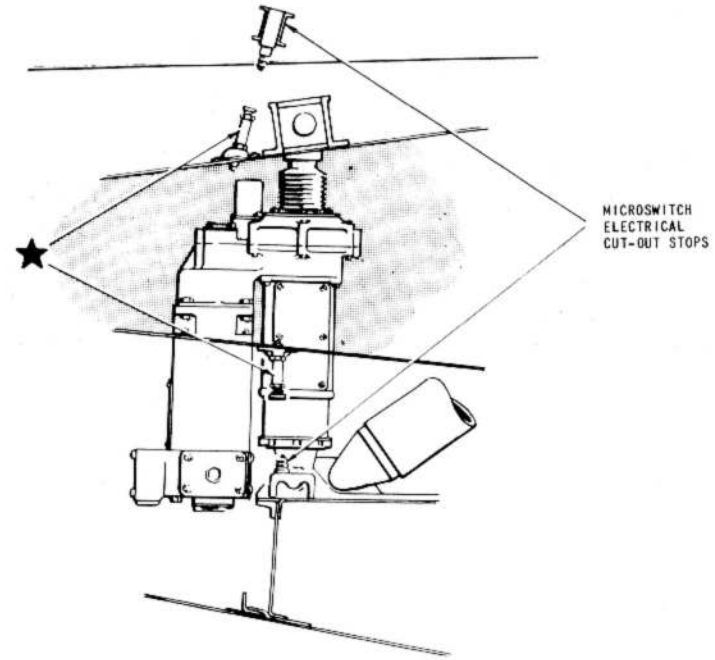


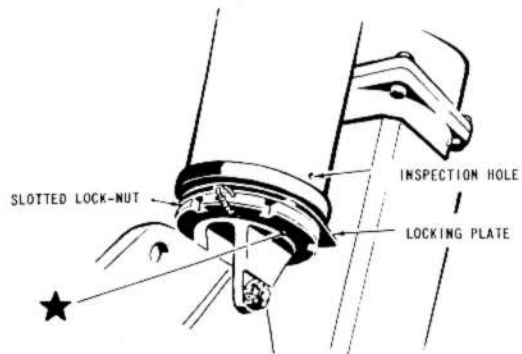
Fig. 11. Tail plane actuator settings



UPPER ATTACHMENT

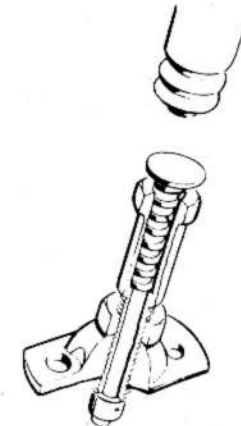


MICROSWITCH
ELECTRICAL
CUT-OUT STOPS



LOWER ATTACHMENT
AND CENTRES
ADJUSTMENT POINT

★ ADJUSTMENT POINT



ADJUSTABLE TAPPET

FIG.12. TAIL PLANE ACTUATOR SETTING

ing 3/16 in. thus ensuring that a sufficient amount of thread is in engagement with the ball nut.

(9) Check and record the angle found in operation (7).

(10) Reduce the angle recorded in (9) by $8 \text{ min} \pm \frac{1}{2} \text{ min}$; this will give the angle at which the lower microswitch must be tripped (fig.11).

(11) Adjust the lower tappet to operate the lower microswitch at the angle found in (10).

(12) Extend the actuator on to its mechanical stop and check that the tail plane down travel limit - tail plane leading edge down - is $2 \text{ deg } 4 \text{ min} \pm 4 \text{ min}$ relative to the fuselage horizontal datum (fig.11).

(13) Check and record the correct angle found in operation (12).

(14) Increase the angle recorded in (13) by $8 \text{ min} \pm \frac{1}{2} \text{ min}$; this will give the angle at which the upper microswitch must be tripped (fig.11).

(15) Adjust the upper tappet to operate the upper microswitch at the angle found in (14).

(16) Recheck the operational angles of incidence at both upper and lower actuator positions, moving the actuator slowly when approaching the microswitches, and check that the tail plane indicator in the cabin registers the take-off position when the incidence is $3 \text{ deg } 15 \text{ min} \pm 2 \text{ min}$.

(17) Finally, carry out flight trim checks as specified in Appendix 1.

Air brakes setting (fig.13)

28.

(1) Remove the panels giving access to the air brake mechanism (Sect.2, Chap. 4) from the underside of each main plane.

(2) Set the air brakes and flaps ground selector to GROUND and using the aircraft hand pump, fully extend the jacks.

(3) Check the dimension between the pin centres of the piston-rod and jack body; this should be 24.92 in. Adjustment is effected by unlocking and rotating the eye-end of the jack piston-rod.

(4) Check that all drag-channel end plates are flush with the main plane skin.

(5) Disconnect the hydraulic pipelines

from the starboard jack and blank off. Connect an external hand pump test rig.

(6) Slacken the securing bolts of the cam slide assembly on the jack piston-rod and move the slide a short distance along the piston-rod towards the eye-end of the rod.

(7) Retract the jack to extend the drag channels to the MID position in accordance with the dimension given in fig.13.

(8) Adjust the position of the cam slide on the piston rod to operate the microswitches at this point; tighten and wire-lock the securing bolts.

(9) Disconnect the external test rig from the starboard jack, reconnect the pipelines and bleed the air brake system.

(10) Fully extend the jacks, select MID and OUT, and check that the drag channel protrusion in each position agrees with the dimensions given in fig.13.

Note...

◀ In the MID position the inboard, or outboard, drag channel extensions must not differ by more than 0.5 in. between main planes. ▶

(11) Select IN, extend the jacks, lock all adjustment points and refit the access panels. Ensure that the access panel bolts are all of the same length and diameter. If 14 x 5/16 B.S.F. bolts are fitted, their overall length must be 0.70 in. if 26 x 2 B.A. bolts are fitted their overall length must be 0.60 in.

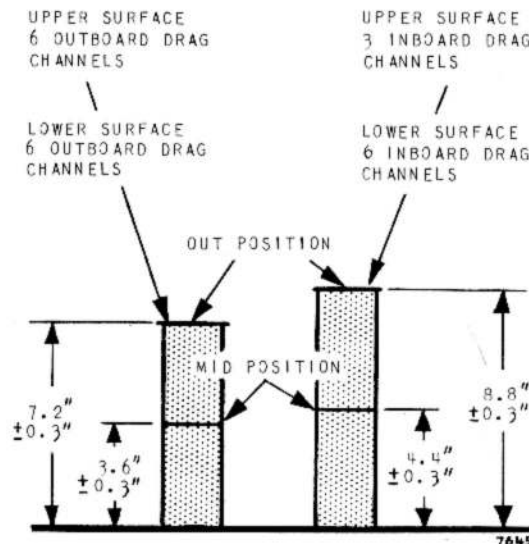


Fig.13. Air brakes setting

(12) Set the air brakes and flap ground selector to FLIGHT and wire-lock all adjustment points.

Flaps setting

29.

Note...

Use the hand pump for operating purposes.

(1) Check that the distance between the pin centres of the flapjack piston-rods is 18.3 in. If adjustment is necessary:-

(a) Remove the locking wire from the locknut and the splined nut at the end of the piston rod.

(b) Slacken the locknut.

(c) Adjust as necessary by turning the eyebolt at the end of the piston rod one complete turn at a time.

(d) Tighten the locknut and relock it to the splined nut.

(2) With the flaps down, remove the locking plates from the links connecting the flaps to their operating levers, and slacken slightly all link adjustment screws (fig.8).

(3) Raise the flaps, moving them slowly when approaching the fully up position, and check that they do not bear on the underside of the main plane when fully up.

(4) Lower the flaps sufficiently to give access to the link adjustment screws and adjust at these points until, when the flaps are fully up, they bear without undue pressure on the underside of the main plane.

(5) The movement of the flaps from the fully up to the fully down position is 29.28 in. \pm 0.50 in. (inboard flap) and 26.65 in. \pm 0.50 in. (outboard flap). This movement is to be measured from the trailing edge of the wing, at the

outboard end of the inboard flap and at the inboard end of the outboard flap. Maximum permissible backlash is 0.3 in. (fig.14), in the new condition, to allow for adverse tolerance of bolts and bores in the total linkage from jack to flap. Where backlash exceeds 0.60 in. refer to A.P.101B-0400-6.

(6) When the correct flap settings have been obtained, check that there is a minimum clearance of 0.050 in. between the pushrod fork-ends and the flap hinge brackets throughout the full flap travel (fig.8). Ensure that all of the free lift in the flap at the hinges has been taken up when this check is made. If this clearance cannot be obtained, it is permissible to file, and remove locally, up to 0.10 in. maximum from the flap hinge bracket to clear the foul; blend out the rebate and restore the local finish (A.P.119A-0509-1).

(7) Refit the locking plates, ensuring that the securing bolts are fitted with their heads to starboard.

Static friction loads

30. The maximum acceptable values for the static friction loads of the control runs are as follows:-

Aileron	-	4 lb
Elevator	-	6½ lb
Rudder	-	6½ lb

Measure the loads with spring balance Ref.No.1A/1275137 connected to the control at the point of application of the pilot's effort. Take readings of the rudder and aileron runs when the control commences to move. Due to the out-of-balance moment of the elevator control run, it is necessary to pull

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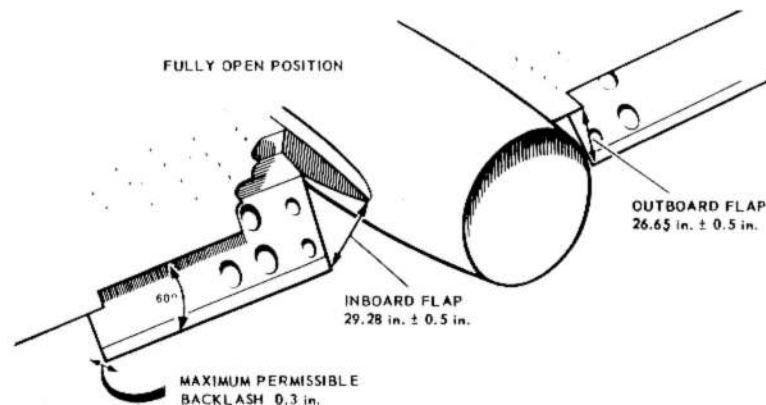


Fig. 14. Flap movement

the control column forward by means of the spring balance, and take the maximum reading. Hold the control column in this position and zero the spring balance, then allow the control column to move back, with the spring balance held, and again take the reading. Half the difference of the two readings will be the static friction load.

Lubrication

31 Refer to fig.18, 18A and 18B.

Note . . .

No grease or oil is to be applied to the roller guides of the flying control push-pull rods.

REMOVAL AND ASSEMBLY

General information

32. The following paragraphs contain information on the removal and assembly of certain components of the flying controls. Only the removal operations are described; assembly is generally the reverse of these operations (where this is not the case, the fact is stated). The recommended sequence of operation is given, although in some cases it will be clear that it is not essential to adhere rigidly to this sequence. Ground equipment is listed in Sect.3, Chap.4.

Control column

33. To remove the control column:-

WARNING

1. Ensure that all relevant safety precautions, as detailed on the **LETHAL WARNING** marker card, have been observed.
2. To prevent ingress of swarf and/or scoring of the inner torque tube, where the control column is fitted with a vertical conduit channel, the channel must not be removed whilst the control column is in situ, nor may the channel attachment rivets be replaced by self-tapping screws.

- (1) Disconnect all electrical supplies.
- (2) Remove the pilot's seat bucket.
- (3) Remove the screws securing the port foot ramp to the floor of the cabin and remove the foot ramp.
- (4) Remove the two leather dust covers from the base of the control column.
- (5) Remove the two sealing cover plates, one at each side of the base of the control column.
- (6) Remove the cover plate in the cabin floor, forward of the control column, and the cover plate in the floor to port of the control column.
- (7) Remove the access panels on the inboard face of the pilot's console (forward end).
- (8) Disconnect the aileron control rod from the lever at the bottom of the control column, and elevator control rod and snatch unit from the pilot's console (Sect.3, Chap.11).

- (9) Disconnect the wheel brakes Bowden cable at the top of the control column and remove the cable adjusters and the clips retaining the Bowden cable to the control column. Remove the cable.

◀ **CAUTION**

Prior to reassembly of the Bowden cable to the control valve, check the cable for damage to the strands and for kinking. If either are evident the cable must be replaced.

When a new cable is to be fitted the nipple end may require dressing to suit the control valve. Extreme care must be used during this process to ensure the cable is not kinked or its strands damaged. ▶

Note . . .

Check the conduit socket EA1.45.123, which retains the brake cable at the top of the control column, for security of the rivets, before replacing the cable (Fig.1).

- (10) Disconnect the electrical cables from the terminal block beneath the cabin floor, forward of the control column.
- (11) Remove the eight 2 B.A. bolts securing the elevator torque tube bearing retaining plate to the inner face of the console.
- (12) Remove the four ¼ in. bolts from the control column support casting.
- (13) Partly lift the control column, release the bias spring from its attachment on the aileron control lever, move the control column slightly to starboard and remove it from the cabin floor.

Rudder bar

34. To remove the rudder bar:-

- (1) Disconnect the control rod from the rudder main operating lever at the bottom of the rudder bar torque tube.
- (2) Disconnect the brake control valve lever from the rudder main operating lever.
- (3) Remove the four ¼ in. nipples from the two spokes retaining the rudder main operating lever to the rudder bar torque tube, and withdraw the spokes.
- (4) Remove the rudder control lever.
- (5) Remove the eight ¼ in. bolts securing the rudder bar pedestal to the cabin floor, and remove the rudder bar.

Note . . .

Close tolerance 5/16 in. bolts may be fitted in lieu of spokes (A.P. 101B-0400-6, Repair Leaflet B.2/27).

Pressure box (fig.3)

35. Whenever a pressure box assembly has been removed and replaced a cabin pressure test must be made in accordance with the instructions given in Chap.8. Each control must be moved over its full range at least three times when the pressure test is in progress. Refer to

the associated rigging diagram and reset the lever limit stops.

Note...

It may be found on reassembly that a new rubber seal Ref.No.26FZ/12173 is required between the bulkhead and pressure box.

Spring tab mechanisms

Aileron

36. For the removal of a spring tab mechanism refer to fig.19.

Port elevator

37. For the removal of the spring tab mechanism refer to fig.20.

Rudder

38. For the removal of the spring tab mechanism refer to fig.21.

Aileron bias actuator (fig.2)

39. To remove the aileron bias actuator :-

- (1) Remove the floor cover plate forward of the control column.
- (2) Disconnect the electrical cables from the actuator.
- (3) Turn the control column hand wheel fully to starboard; this will give greater ease of access to the aileron bias lever.
- (4) Remove the split pin and nut from the shouldered bolt connecting the actuator ram to the actuator lever, and remove the bolt.
- (5) Remove the bolt securing the actuator to the floor beam, and remove the actuator.

Rudder trim actuator

40. To remove the rudder trim actuator:-

- (1) Remove the actuator access panel on the starboard side of the fin.
- (2) Disconnect the electrical cables from the actuator.
- (3) Remove the split pin and nut from the bolt connecting the actuator ram to the actuator lever and remove the bolt.
- (4) Remove the split pin from the shouldered bolt attaching the actuator to the mass balance lever and remove the bolt.
- (5) Remove the actuator.

Tail-plane actuator

Removal

41. To remove the tail-plane actuator:-

- (1) Set the tail plane to its mid-travel position.
- (2) Remove the fuselage rear cone fairing and the rear fuselage fairing below the rudder (Sect.3, Chap.1).
- (3) Disconnect the electrical cables from the actuator.
- (4) Remove the five seal adjustment bolts from each side of the tail plane.
- (5) Attach sling (Sect.2, Chap.4, Table 1) to the tail plane (Sect.3, Chap.3).
- (6) Remove the split pin and nut from the bolt attaching the actuator to the reinforcement piece on frame 46 of the fuselage.

(7) Raise the sling until it takes the weight of the tail plane off the actuator, and withdraw the actuator attachment bolt.

(8) Remove the locking pin from the bolt connecting the actuator ram to the tail plane, and withdraw the bolt.

(9) Withdraw the actuator from the underside of the tail plane.

Note...

When the actuator has been removed, a jury strut Ref.No.26FZ/95090 must be fitted before detaching the tail-plane sling.

Assembly

42. Assemble the tail-plane actuator to the aircraft in the reverse order to that given in para.41 and carry out the following checks:-

- (1) The tail plane must be set to the neutral position, i.e. 3 deg 56 min incidence measured at the starboard rigging position, and the sealing strips adjusted to give the following clearances:-
 - (a) Between the sealing strips (2-bolt position) and the tail-plane stub fairing, 0.04 in. minimum.
 - (b) Between the sealing strips (3-bolt position) and the tail-plane stub fairing, 0.02 in. minimum.
- (2) Ensure complete freedom of movement throughout the full range of tail plane travel.

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(3) Whenever a tail plane actuator has been replaced or adjusted, a flight trim check (*Appendix 1*) must be made.

Flying control rod assemblies

43. The fork-end fittings of flying control rods are machined with a counter-bored recess on the outer face of one of the lugs concentric with the bolt hole. This recess is provided to accommodate the nut, when the rods are connected. Should the bolt be reversed on assembly, i.e. fitted with the bolt head in the recess, fouling with the airframe may occur at frame 12. An exception is at the connection of the

control rods to the aileron levers, at which point the bolt 'J' (*fig.15*) must be located in the recess in the forked end.

Limits on Fairey roller guides

44. During assembly of the control rods, the following procedure should be adopted to obtain the correct clearance between the control rods and the roller guides: -

- (1) Assemble the control rods through the fairleads.
- (2) Release the locking screw in each

adjustable roller guide assembly and, at the point of maximum diameter, adjust until the three rollers in each assembly are in contact with the control rods.

(3) Tighten the locking screws and recheck the adjustment.

(4) Move the control rods to the slackest position of travel, at which point the following clearances between the rod and any one roller must not exceed 0.006 in. at the fairlead nearest to any lever motion and 0.012 in. at any other fairlead.

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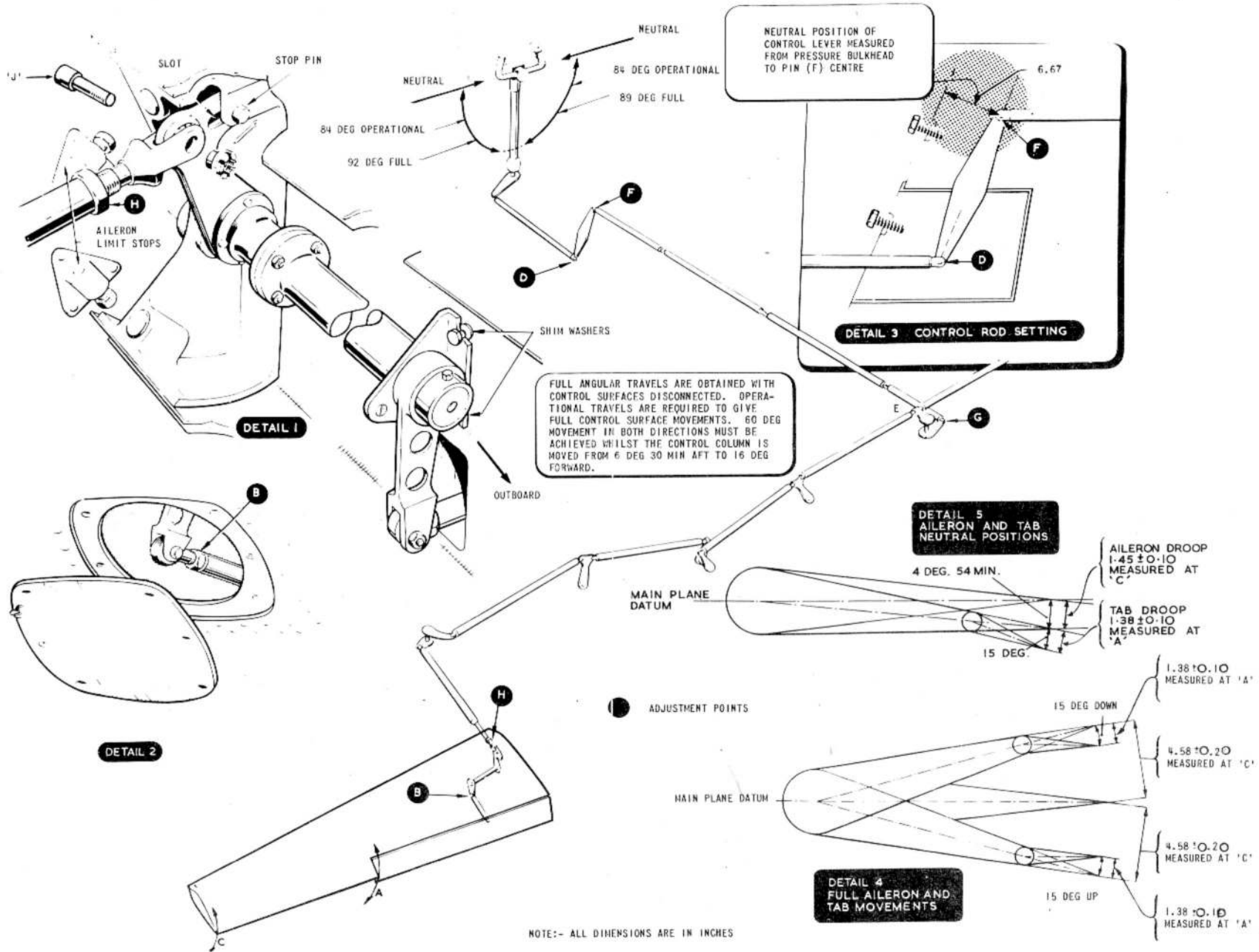


FIG. 15 AILERON CONTROL RIGGING

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KEY TO FIG. 17 (RUDDER CONTROL RIGGING)

To rig the rudder control:-

(1) Disconnect the rudder control rod (*detail 1, point A*) from the upper end of the control lever, and screw back the upper and lower stop-screws on the pressure bulkhead. These operations, except for the lower limit stop-screw, can be made through the port equipment compartment on the port side of the fuselage. The lower limit stop-screw is on the forward face of the pressure bulkhead.

(2) Turn the adjustment screw on the rudder bar until the pedals are in their neutral position and the two portions of the rudder bar are in line.

(3) Set the rudder bar in its neutral position (at right angles to the centre line of the fuselage) and lock it in this position.

(4) Set the control lever, aft of the pressure bulkhead, to its neutral position (6.67 in. measured square from the pressure bulkhead to the upper control attachment bolt centre) by adjusting the control rod at point B (*detail 1*).

(5) Unlock the rudder bar and apply port rudder until the port pedal is 28 deg 30 min forward of the neutral position. Adjust the lower control limit stop-screw on the pressure bulkhead (*detail 1*) until it contacts the lower arm of the lever. Tighten the locking nut.

(6) Apply starboard rudder until the starboard pedal is 26 deg forward of the neutral position and adjust the

upper control limit stop-screw on the pressure bulkhead (*detail 1*) until it contacts the upper arm of the lever. Tighten the locking nut.

(7) Reconnect the rudder control rod (*detail 1, point A*) to the upper end of the lever at the pressure bulkhead.

(8) Lock the rudder bar at neutral.

(9) Disconnect the control rod from the rudder lever at point E, and lock the rudder in its neutral position by applying a clamp between the lower edge of the rudder and rudder stub, forward of the spring tab.

(10) Operate the trim tab actuator until its pin centres are set at 8.9 in. \pm 0.125 in. and adjust the tab actuating rod on the starboard side of the rudder until the tab is in line with the rudder.

(11) Set the control lever (*detail 2*) on the bulkhead at frame 42 to its neutral position (8.65 in. \pm 0.1 in., measured square from the bulkhead to the control attachment bolt centre) by adjusting the control rod at point D.

(12) Reconnect the control rod to the rudder lever at point E, adjusting the fork-end of the control rod at points C or E, as necessary.

(13) Remove the lock from the rudder and unlock the rudder bar.

(14) Apply port rudder until the rudder stop is contacted and check the rudder movement; it should be 25 deg to port

(linear dimension 23.1 in. \pm 1.0 in. at point G).

(15) Apply further port rudder until the tab has moved 18 deg to starboard (linear dimension measured from the in-board edge of the tab to the centre of the trailing edge of the rudder should be 1.73 in. $^{+0}_{-0.1}$ in. as shown in *detail 3*).

(16) Repeat operations (14) and (15) but with starboard rudder and check the movement of the rudder and tab; these should be the same as for port rudder.

Note...

1. The measurements given in operations (14) and (15) are obtained with the rubber stop-pads removed. With the stop-pads in position and normal force applied to the rudder bar, the linear measurement given in operation (14) should be 21.75 in. \pm 1.0 in.

2. If the rudder tab movement, operation (15), is in excess of 18 deg, a new rudder tab operating lever stop plate Ref.No.26FZ/5495 (*fig.21*) should be fitted, and the stop-faces filed, if necessary, to obtain the desired 18 deg movement. Similarly, if the 18 deg movement is unobtainable, the existing stop plate may be filed. Protective treatment (A.P.119A-0509-1) must be applied to all filed surfaces.

(17) Ensure that all adjustment points are securely locked and that the control rod couplings do not foul the roller guides at any position of the rudder bar.

KEY TO FIG. 15 (AILERON CONTROL RIGGING) - continued

to the aileron lever (*detail 1*) and unlock the hand wheel.

(15) Move the hand wheel in both directions until the movement is arrested by the down aileron limit stop. It will be noted that the down aileron reaches its limit stop in advance of the up aileron. Further movement of the hand wheel in both directions will give the ailerons and tabs their respective full movements (*detail 4*).

(16) Ensure that all adjustment points are securely locked and that the control rod couplings do not foul the roller guides during any position of the aileron control movement.

(17) Carry out flight trim checks (*Appendix 1*).

Aileron fixed trim strips

The neutral position of the aileron fixed trim strip on each aileron is in line with the aileron chord line. These strips are set by the manufacturer and the setting should not normally need alteration. If, however, adjustment is necessary, progressive adjustment to a maximum of 10 deg either up or down from the neutral position may be made

on the ground, using setting tool and gauge (*Sect.2, Chap.4, Table 1*).

Note...

1. An adjustment of 3 deg up on one fixed trim strip and 3 deg down on the other is equivalent to five divisions on the aileron trim indicator when the aircraft is flying at 450 knots I.A.S.

2. The bolt J must be inserted from inboard and the bolt head must be located in the recess in the forked end; to achieve this condition when adjusting the controls it may be necessary to rotate the complete rod assembly through 180 deg so that the recess faces inboard.

Rigging of aileron controls following replacement of control rods and levers, frame 21 to aileron attachment (*fig.15*) The following method of rigging the aileron controls, port and starboard, is recommended.

(1) Set inboard adjustable control rods bell crank lever to lever arm at rib 4, centre wing, to nominal length (1½ turns in from the safety check hole).

(2) Ensure that the lower arm of the

bell crank lever aft of main spar frame is parallel to the main spar.

(3) Fit control rods as follows:-

(a) Bell crank lever to lever arm, rib 4, centre wing.

(b) Lever arm to centre lever, engine bay.

(c) Centre lever to lever arm, rib 2, outer wing.

(d) Lever arm to hinge mounting assembly, rib 4, outer wing.

(e) Hinge mounting to aileron. Adjust for correct aileron droop. Check for safety.

Note...

Due to the fact that the control rod attachment bolt to aileron, is required to be fitted with the head in the recess in the fork end, and facing inboard, adjustment at this point can only be made in full turns in or out as required. In the event of a half turn adjustment being required, the full turn should be applied, and a half turn adjustment made in the opposite direction at the adjustable end of the bell crank lever to lever arm control tube at rib 4, centre wing.

◀ KEY TO FIG. 16 AND 16A (ELEVATOR CONTROL RIGGING) ▶

To rig the elevator control:-

(1) Jack and trestle the aircraft laterally and longitudinally level (*Sect.2, Chap.4*).

(2) Disconnect the elevator control rod (*detail 1, point B*) from the upper end of the lever, and screw back the upper and lower stop-screws on the pressure bulkhead. These operations, except for the lower limit stop-screw, can be made through the port equipment compartment on the port side of the

fuselage. The lower limit stop-screw is on the forward face of the pressure bulkhead.

(3) Set the control column to its neutral position (6 deg 30 min forward of the vertical) using a clinometer applied to the rear of the control column. Lock the control in this position.

(4) Set the control lever aft of the pressure bulkhead (*detail 1*), to its neutral position (6.22 in. measured square from the pressure bulkhead to the

upper control attachment bolt centre), by adjusting the control tube at point A or C.

Note...

Any adjustments made at the pressure bulkhead may affect the clearances at the snatch unit sear operating lever. Check the dimensions in accordance with *Chap.11, fig.1*.

WARNING

Unlock the control column, move it through its full travel in both direc-

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◀ KEY TO FIG. 16 AND 16A (ELEVATOR CONTROL RIGGING) - continued ▶

tions, and ensure that the explosive collar does not foul the adjacent structure. If it is necessary to move the collar, ensure that the red line is repainted on the rod on either side of the collar, and that the original red line is obliterated.

(5) Unlock the control column, and move it 16 deg forward of the vertical. Adjust the upper limit stop-screw on the pressure bulkhead (*detail 1*) until it contacts the upper arm of the control lever. Tighten the locking nut.

(6) Move the control column 6 deg 30 min aft of the vertical and adjust the lower limit stop-screw on the pressure bulkhead (*detail 1*) until it contacts the lower arm of the control lever. Tighten the locking nut.

(7) Reconnect the elevator control rod (*detail 1, point B*) to the upper end of the lever aft of the pressure bulkhead.

(8) Disconnect the elevator control rod at point D (*detail 2*) from the lever on the bulkhead at frame 42; access is through the rear camera hatch.

(9) Set the tail plane in the take-off position with the incidence gauge at the starboard tail plane inboard position reading 3 deg 15 min \pm 2 min, and the tail plane incidence gauge in the cabin at the take-off position.

(10) Manually move the elevator down and adjust the elevator lower limit stop at the starboard elevator link lever to give the elevator horn an upward movement of 15 deg (linear dimension 8.4 in. \pm 0.3 in., measured from the leading edge of the tail plane to the leading edge of the elevator horn (*point F*)).

(11) Manually move the elevator upwards and adjust the elevator upper limit stop at the starboard elevator link lever to give the elevator horn a downward movement of 20 deg (linear dimension 11.16 in. \pm $\begin{smallmatrix} 0.30 \\ 0.50 \end{smallmatrix}$ in. measured as for operation (10)).

Note...

The measurements given in operations (10) and (11) are obtained with the rubber stop-pads removed; with the stop-pads in position the measurements will be slightly less.

(12) With the tail plane in the take-off position (*operation (9)*), lock the elevator in its neutral position - in line with the chord line of the tail plane - by fitting the external control lock to the starboard elevator, and a toggle between the port elevator horn and the tail plane.

(13) Adjust the port tab control rod until the tab is 12 deg 30 min up; linear measurement 1.30 in. \pm 0.10 in. measured between the trailing edges of the tab and the elevator.

(14) Ensure that the stop pin is in the centre of the tab-operating arm.

(15) With the tail plane, elevator, and port tab in their neutral positions set the control lever on the bulkhead at frame 42 to its neutral position (6.35 in. \pm 0.1 in., measured square from the bulkhead to the control attachment bolt), by adjusting the control rod at point E.

(16) Lock the control column in the neutral position, reconnect the control rod at point D (*detail 2*) to the lever on the bulkhead at frame 42, adjusting

the rear end of the main control rod (*point D*) as necessary.

(17) Unlock the control column and elevators, and check the elevator and tab movement. The elevator movements should be those given in operations (10) and (11). The linear dimensions of the starboard tab movement should be that given in para. 24. Relock the port elevator and check the movements (*point G*) of the port spring tab which should be:-

Elevator tab up	1.70 in. min.
Elevator tab down	0.60 in. min.

measured between the trailing edges of the tab and elevator. When the port tab is moved to its fully up position, the relative tab to elevator angle is approximately 21 deg. (About this position a foul occurs between the tab mass balance and the elevator skin; this is acceptable as the 21 deg tab angle never occurs in flight. However, this position can be reached during ground checks when the control column is moved through its full travel, or when the spring tab is moved by hand to check for defective torque tube blow-back rod assemblies.) Unlock the port elevator.

Note...

When the elevator tabs are being moved to the extreme travel position, the operation is to be performed gently, thereby avoiding heavy contact between the balance weights and skin.

(18) Ensure that all adjustment points are securely locked and that the control rod couplings do not foul the roller guides at any point of the control column movement.

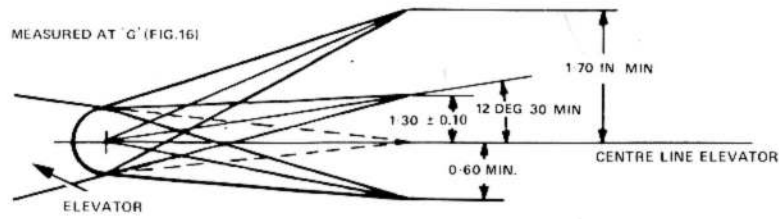
(19) Carry out flight trim checks (*Appendix 1*).

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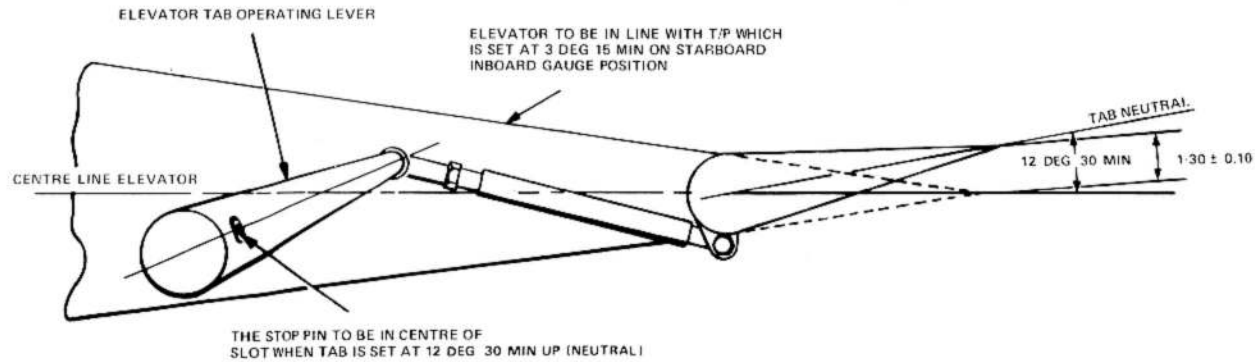
DETAIL A

NOTE...

UP TRAVEL AND DOWN TRAVEL IS LIMITED
BY STOP-PIN IN ELEVATOR TAB-OPERATING LEVER



PORT TAB MOVEMENT - ELEVATOR LOCKED NEUTRAL



PORT ELEVATOR TAB RIGGING

NOTE...
ALL DIMENSIONS ARE IN
INCHES, UNLESS OTHERWISE
STATED

FIG. 16A ELEVATOR CONTROL RIGGING (2)

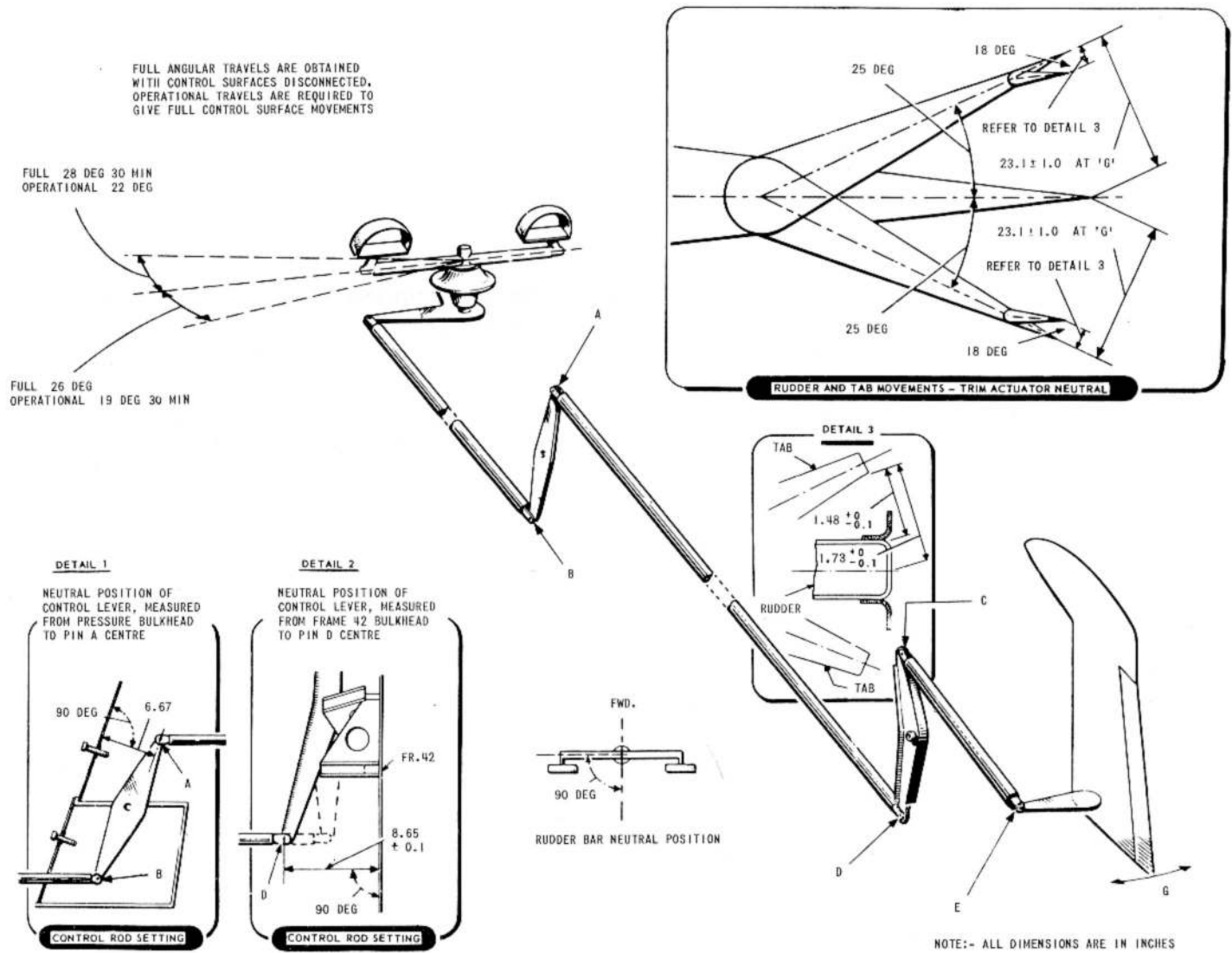


FIG.17. RUDDER CONTROL RIGGING

KEY TO FIG. 17 (RUDDER CONTROL RIGGING)

To rig the rudder control:-

- ◀ (1) Disconnect the rudder control rod (*detail 1, point A*) from the upper end of the control lever, and screw back the upper and lower stop-screws on the pressure bulkhead. These operations, except for the lower limit stop-screw, can be made through the port equipment compartment on the port side of the fuselage. The lower limit stop-screw is on the forward face of the pressure bulkhead.
- (2) Turn the adjustment screw on the rudder bar until the pedals are in their neutral position and the two portions of the rudder bar are in line.
- (3) Set the rudder bar in its neutral position (at right angles to the centre line of the fuselage) and lock it in this position.
- (4) Set the control lever, aft of the pressure bulkhead, to its neutral position (6.67 in. measured square from the pressure bulkhead to the upper control attachment bolt centre) by adjusting the control rod at point B (*detail 1*).
- (5) Unlock the rudder bar and apply port rudder until the port pedal is 28 deg 30 min forward of the neutral position. Adjust the lower control limit stop-screw on the pressure bulkhead (*detail 1*) until it contacts the lower arm of the lever. Tighten the locking nut.
- (6) Apply starboard rudder until the starboard pedal is 26 deg forward of the neutral position and adjust the

upper control limit stop-screw on the pressure bulkhead (*detail 1*) until it contacts the upper arm of the lever. Tighten the locking nut.

(7) Reconnect the rudder control rod (*detail 1, point A*) to the upper end of the lever at the pressure bulkhead.

(8) Lock the rudder bar at neutral.

(9) Disconnect the control rod from the rudder lever at point E, and lock the rudder in its neutral position by applying a clamp between the lower edge of the rudder and rudder stub, forward of the spring tab.

(10) Operate the trim tab actuator until its pin centres are set at 8.9 in. \pm 0.125 in. and adjust the tab actuating rod on the starboard side of the rudder until the tab is in line with the rudder.

(11) Set the control lever (*detail 2*) on the bulkhead at frame 42 to its neutral position (8.65 in. \pm 0.1 in., measured square from the bulkhead to the control attachment bolt centre) by adjusting the control rod at point D.

(12) Reconnect the control rod to the rudder lever at point E, adjusting the fork-end of the control rod at points C or E, as necessary.

(13) Remove the lock from the rudder and unlock the rudder bar.

(14) Apply port rudder until the rudder stop is contacted and check the rudder movement; it should be 25 deg to port

(linear dimension 23.1 in. \pm 1.0 in. at point G).

(15) Apply further port rudder until the tab has moved 18 deg to starboard (linear dimension measured from the in-board edge of the tab to the centre of the trailing edge of the rudder should be 1.73 in. $^{+0}_{-0.1}$ in. as shown in *detail 3*).

(16) Repeat operations (14) and (15) but with starboard rudder and check the movement of the rudder and tab; these should be the same as for port rudder.

Note...

1. The measurements given in operations (14) and (15) are obtained with the rubber stop-pads removed. With the stop-pads in position and normal force applied to the rudder bar, the linear measurement given in operation (14) should be 21.75 in. \pm 1.0 in.

2. If the rudder tab movement, operation (15), is in excess of 18 deg, a new rudder tab operating lever stop plate Ref. No. 26FZ/5495 (*fig. 21*) should be fitted, and the stop-faces filed, if necessary, to obtain the desired 18 deg movement. Similarly, if the 18 deg movement is unobtainable, the existing stop plate may be filed. Protective treatment (A.P. 2662B) must be applied to all filed surfaces.

(17) Ensure that all adjustment points are securely locked and that the control rod couplings do not foul the roller guides at any position of the rudder bar. ▶

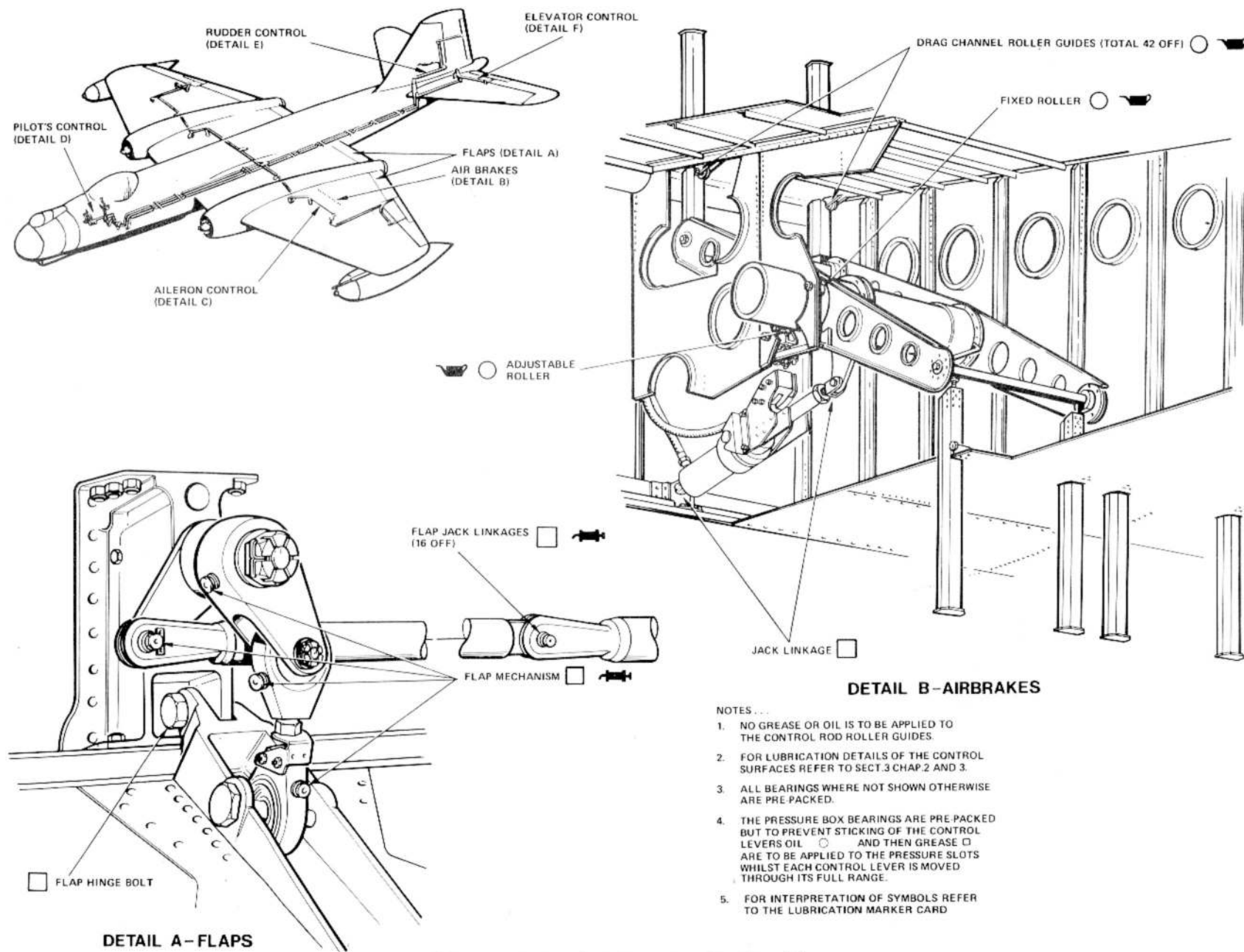
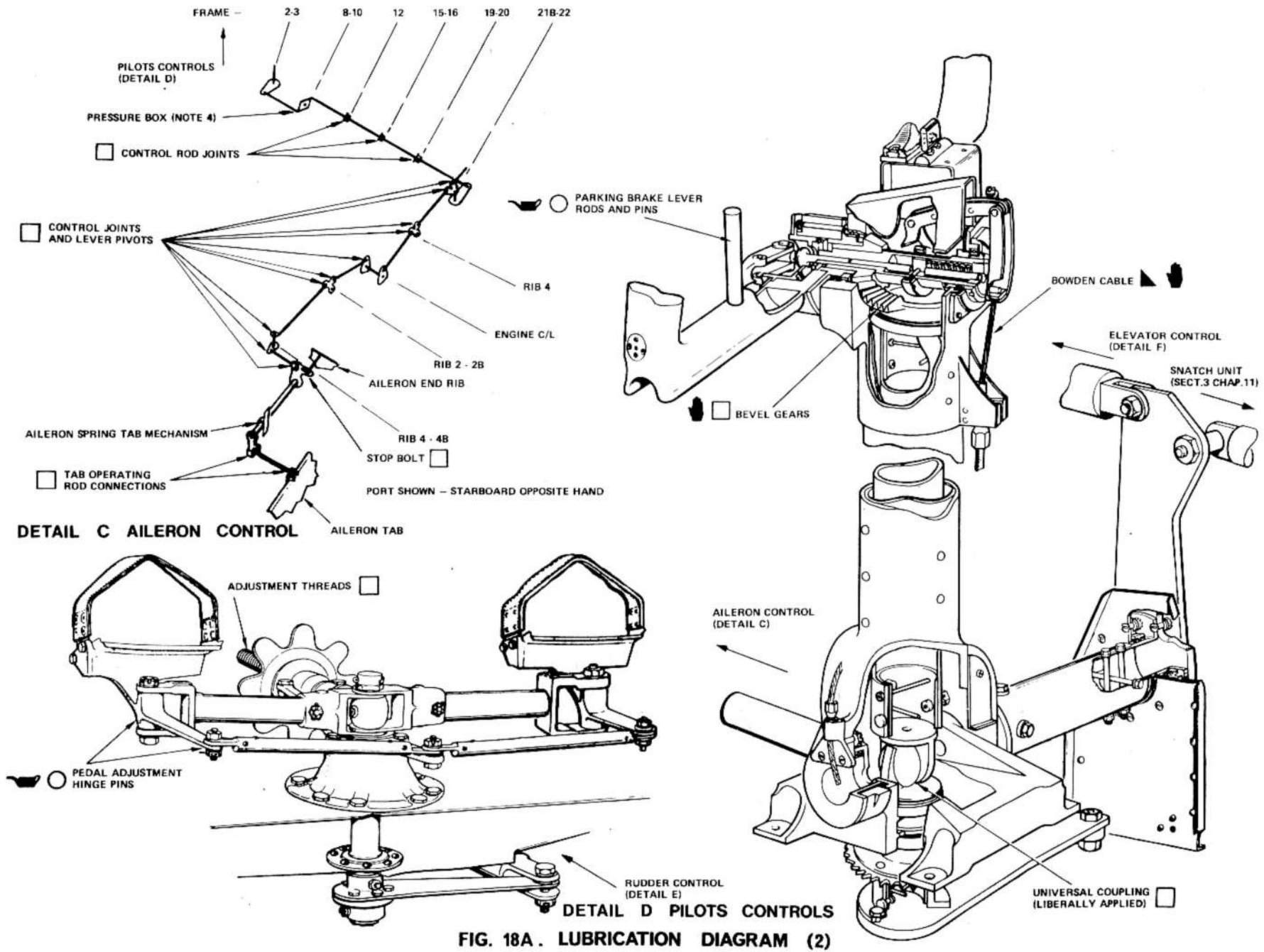


FIG. 18. LUBRICATION DIAGRAM (1)

◀REDRAWN▶

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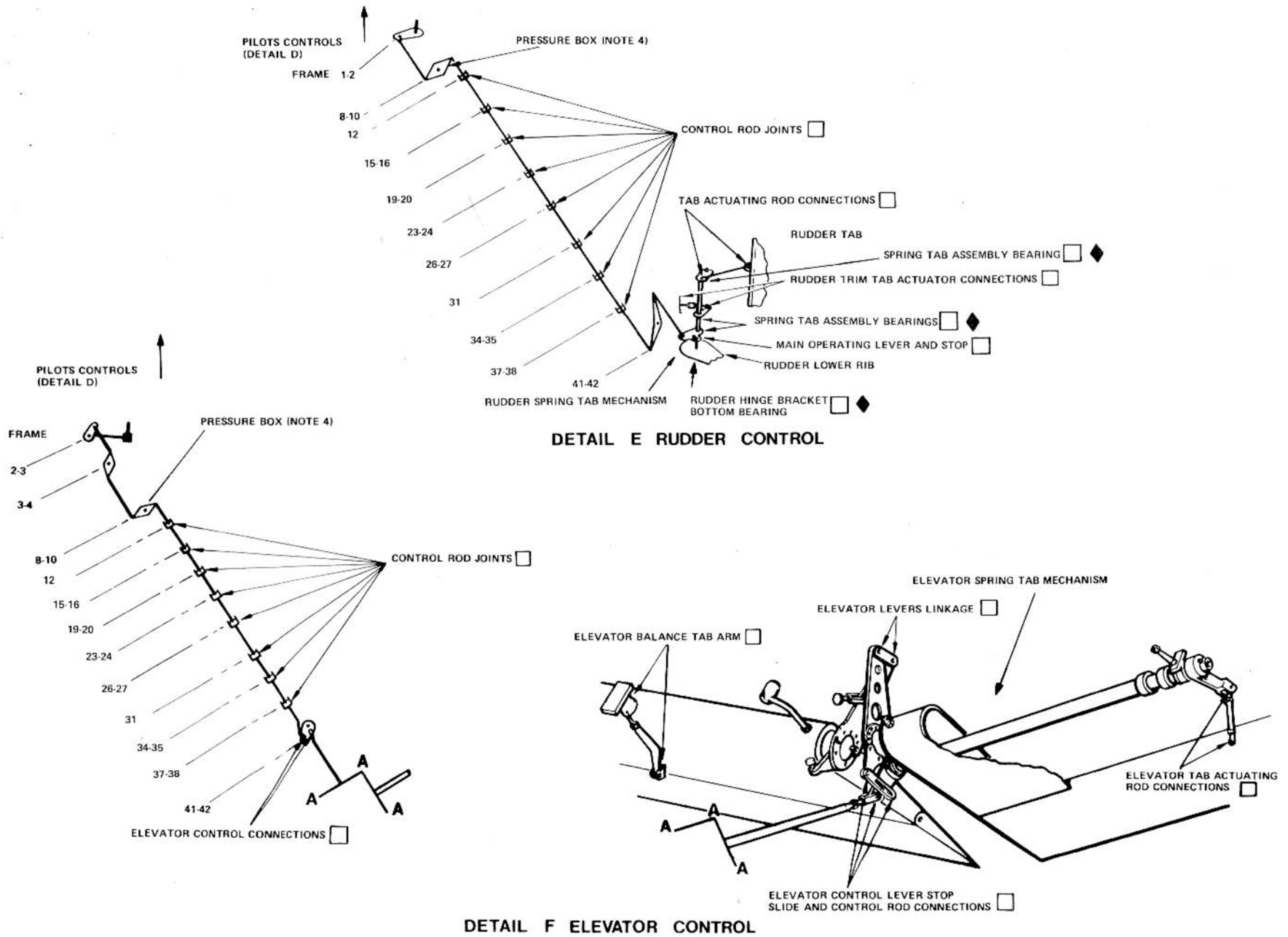


FIG. 18B. LUBRICATION DIAGRAM (3)

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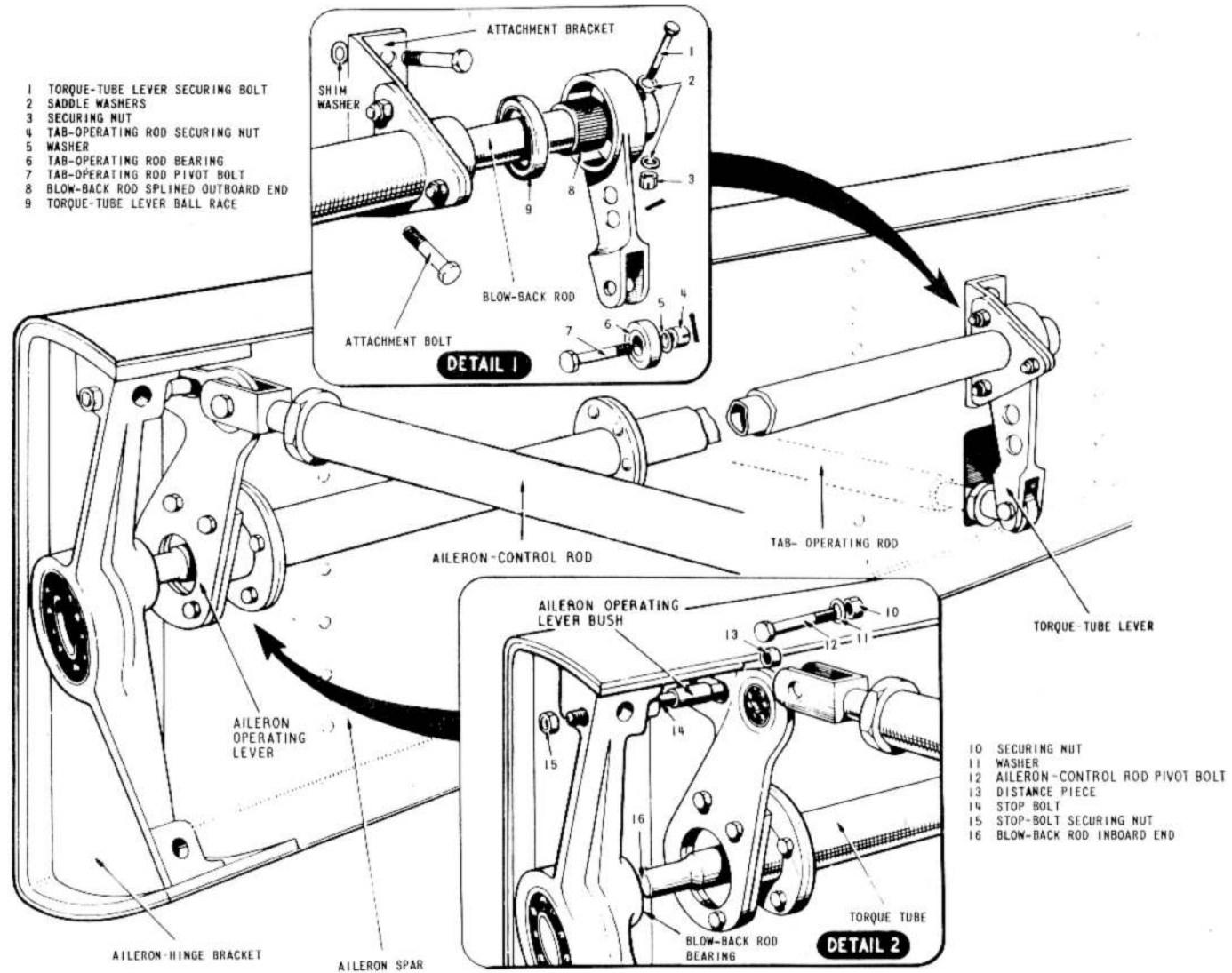


FIG.19. AILERON SPRING TAB MECHANISM REMOVAL

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KEY TO FIG. 19 (AILERON SPRING TAB MECHANISM REMOVAL)

To remove an aileron spring tab mechanism:-

- (1) Remove the aileron (Sect.3, Chap.2).
- (2) Remove the access panel from the leading edge of the aileron and disconnect the tab operating rod from the torque tube lever.
- (3) Remove the stop bolt and bush from the slot in the aileron operating lever at the inboard end of the tab operating gear assembly (detail 2).
- (4) Remove the bolt securing the tab operating lever to the blow-back rod at the outboard end of the assembly (detail 1).
- (5) Using extractor Ref.No. 26FZ/95044, withdraw the tab operating lever from the splines of the blow-back rod (detail 1).
- (6) Remove the two bolts attaching the mounting bracket, at the outboard end of the tab operating mechanism, to the spar (detail 1).

Note...

Between the mounting bracket and the aileron spar two shim washers are fitted, each 0.040 in. thick, which are used to adjust the spring tab mechanism (detail 1). It is important that these shim washers are refitted in their original positions, as neglecting to do this may subject the torque tube assembly to undue strain.

- (7) Ease the spigot at the inboard end of the tab operating mechanism from its ball race, and withdraw the mechanism from the aileron.

Sequence of assembly:-

The assembly sequence for refitting the existing spring tab mechanism is the reverse of that given for the removal.

Assembly of a new spring tab mechanism:-

- (1) Separate the mounting bracket from the original tab operating mechanism by removing the nuts from the three countersunk bolts.
- (2) Assemble the original mounting bracket to the new spring tab mechanism, with the flange of the bracket positioned approximately parallel to the bolt hole in the splined end of the blow-back rod.
- (3) Assemble the mechanism into the aileron and temporarily bolt the mounting bracket to the aileron spar, fitting between the mounting bracket and the spar, a shim washer at both bolt positions.
- (4) Assemble the stop bolt and bush through the slot in the aileron operating lever at the inboard end of the tab operating gear (detail 2).
- (5) Assemble the torque tube lever to the splined end of the blow-back rod,

and fit the bolt, nut, saddle washers, and split pin (detail 1).

- (6) Fit the tab-operating rod.
- (7) Check that with the stop bolt at the aft end of the slot in the aileron operating lever there is no pre-loading in the torque tube. If pre-loading is found, adjustment to relieve it may be made on the mounting bracket attachment bolts by transferring a shim washer from one bolt position to the other.

Note...

It is important that the existing torque tube centres are maintained, it therefore follows that a shim washer (0.040 in. thick) removed from one bolt position (detail 1) must be fitted at the other bolt position. The shims, which are placed between the attachment bracket and the aileron spar, can be fitted one at each bolt position or two at one bolt position; the latter case would give an 0.080 in. thick shimming at the one bolt position and leave a direct bracket-to-aileron spar fitting at the other.

- (8) Adjust the tab-operating rod to give the tab a 15 deg droop.
- (9) Refit the aileron to the aircraft (Sect.3, Chap.2).
- (10) Rig the aileron controls (fig.15).
- (11) Carry out flight trim checks (Appendix 1).

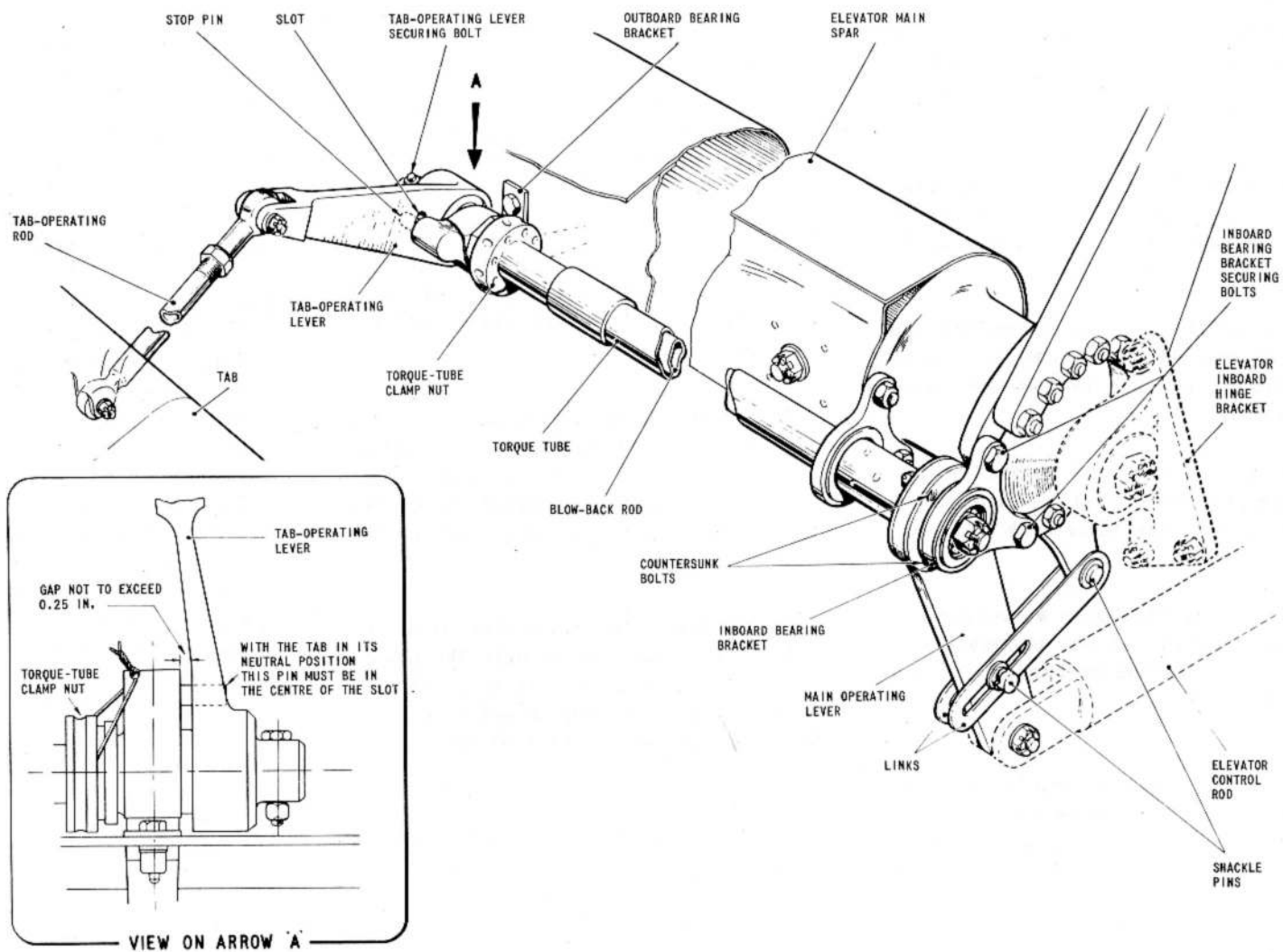


FIG.20. PORT ELEVATOR SPRING TAB MECHANISM REMOVAL

KEY TO FIG. 20 (PORT ELEVATOR SPRING TAB MECHANISM REMOVAL)

Sequence of removal:-

(1) Refer to Sect.3, Chap.3, and remove the port elevator from the aircraft.

(2) Obtain access to the outboard end of the tab operating gear assembly by removing the panel in the top surface of the elevator.

(3) Unfasten the nut and withdraw the bolt that secures the tab operating lever to the extreme outboard end of the tab operating gear assembly.

(4) Remove the split pin from the shackle pin, and withdraw the shackle pin from the slots in the links at the inboard end of the tab operating gear, and allow the links to swing downwards clear of the main operating lever.

(5) Remove the two nuts and withdraw the bolts securing the bearing bracket to the elevator main spar at the extreme inboard end of the torque tube assembly.

(6) Break the locking wire and slacken the torque tube clamp nut which secures the outboard end of the assembly to the outboard bearing bracket; the complete torque tube assembly can then be withdrawn through the inboard end of the elevator.

Sequence of assembly:-

(1) Offer up the torque tube, the in-

board bearing bracket, the blow-back rod, and the main operating lever, to the elevator.

(2) Pass the splined end of the torque tube through the clamp nut into the tab operating lever, and fit and tighten the tab operating lever securing bolt.

(3) Fit the two bolts which attach the inboard bearing bracket to the elevator main spar.

(4) Tighten the torque tube clamp nut, and ensure that the gap between the outboard bearing bracket and the tab operating lever does not exceed 0.25 in. (*view on arrow A*).

Note...

If this dimension cannot be obtained, or when fitting a new rod, refer to A.P.101B-0400-6, Repair Leaflet D.4/2.

(5) Secure the links to the main operating lever by fitting the shackle pin together with its associated washers and split pin.

(6) With the top surface of the elevator uppermost, the centres of the shackle pins must be 3.12 in. apart. With the stop pin in the centre of the slot of the tab operating lever (*detail 1*), and the tab in its neutral position (12 deg 30 min up), clamp together the main

operating lever and the flanges of the torque tube and blow-back rod.

(7) Check the tab movements.

(8) From the 5/32 in. dia. pilot holes in the flange of the blow-back rod, drill and ream (0.185 in. dia.) the main operating lever and the flange of the torque tube. Secure the assembly with four countersunk bolts, and remove the clamps fitted in operation (6).

(9) Wire-lock the torque tube clamp nut.

(10) Fit the access panel to the top surface of the elevator.

(11) Refit the elevator to the aircraft (*Sect.3, Chap.3*).

(12) Rig the elevator controls (*fig.16*).

(13) Carry out flight trim checks (*Appendix 1*).

Note...

The above instructions are for fitting a new blow-back rod, torque tube, and main operating lever. If the torque tube and blow-back rod assembly is being re-fitted in the same elevator from which it was removed, the fitting of the clamps, drilling and reaming, will not be necessary.

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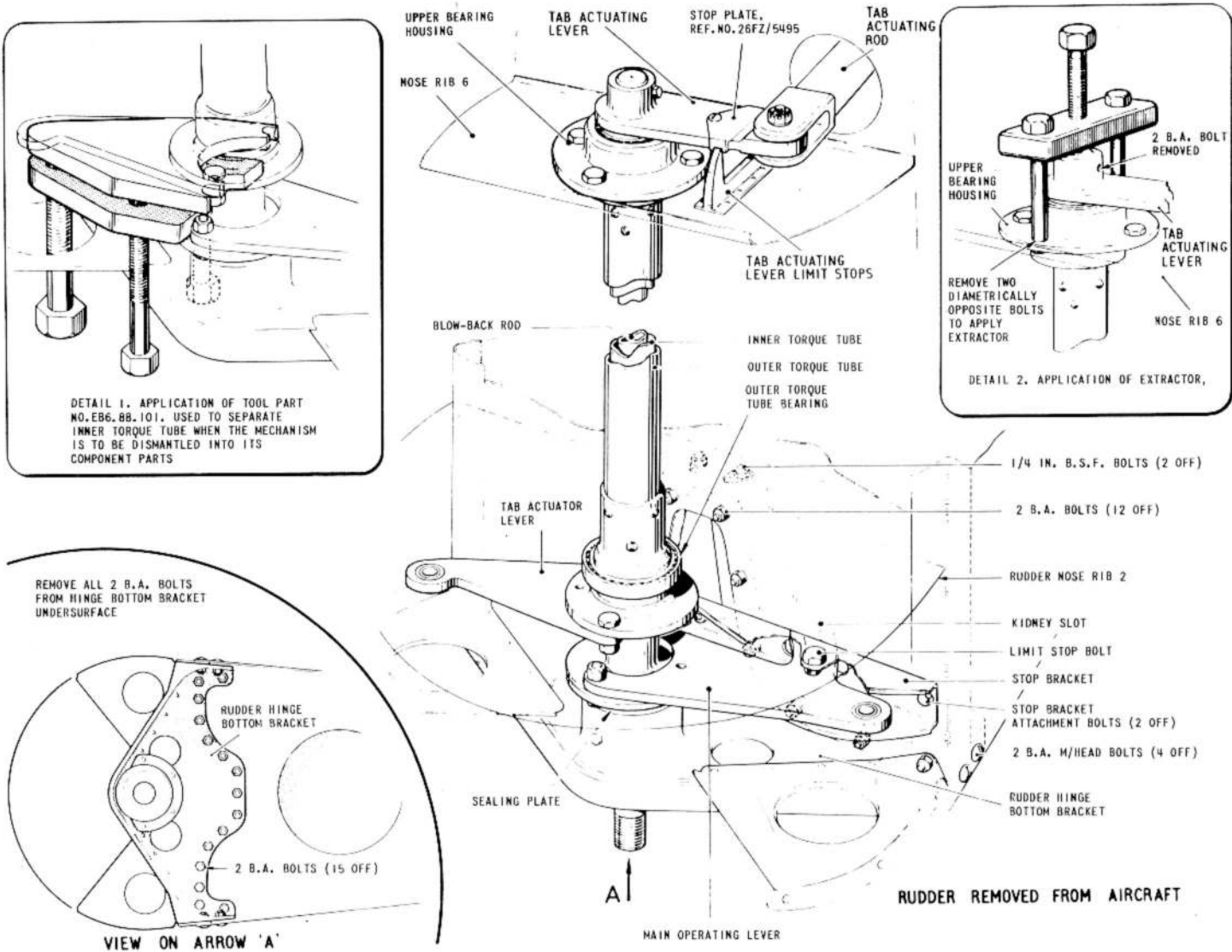


FIG.21. RUDDER SPRING TAB MECHANISM REMOVAL
◀ANNOTATIONS AMENDED▶

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KEY TO FIG. 21 (RUDDER SPRING TAB MECHANISM REMOVAL)

Sequence of removal:-

- (1) Remove the rudder from the aircraft (Chap.3).
- (2) Remove the two access panels from the base of the rudder nose.
- (3) Disconnect the tab actuator and remove it from the rudder.
- (4) Remove the two 2 B.A. bolts securing the stop bracket to the rudder hinge bottom bracket.
- (5) Remove the two ¼ in. B.S.F. bolts securing the rudder hinge bottom bracket to nose rib 2 behind the rudder spar.
- (6) Remove the thirty-one 2 B.A. bolts which secure the rudder hinge bottom bracket to the rudder.

Note...

Ensure the rudder hinge bottom bracket is completely free from the rudder.

- (7) Remove the access panel at rib 6 from the rudder nose.
- (8) Unfasten the nut and withdraw the bolt that secures the tab actuating lever to the splined end of the blow-back rod.
- (9) Remove two diametrically opposite bolts which secure the upper bearing housing to rib 6, and fit extractor (Sect.2, Chap.4, Table 1) as shown in detail 2.

(10) By operating the extractor, force out the torque tube assembly complete with the rudder bottom hinge bracket and stop bracket, taking care to keep the main operating lever kidney slot clear from the rudder spar.

Note...

In some cases the spring tab mechanism may be extremely difficult to remove; this is generally caused by the upper and outer torque tube bearings binding in their bearing housings. If all the above operations have been correctly followed and the rudder hinge bottom bracket is free, it may be advantageous to remove the main operating lever and, although this will not actually assist in the mechanism removal, a greater twisting movement can be applied to the tab actuator lever, and this action, together with the downward force of the extractor (operation (10)) will free the mechanism from the rudder.

Dismantling procedure:-

(1) Remove the two self-tapping screws which fasten the sealing plate over the bearings at the base of the tab mechanism. Remove the sealing plate. Separate the rudder bottom hinge bracket from the tab mechanism at the bottom bearing using extractor Pt.No.EB6.88.101 (detail 1).

Sequence of fitting a new rudder spring tab mechanism:-

(1) Ensure that the bearings between inner and outer torque tube, also the

outer torque tube bearing are packed with grease as shown in fig.18B.

(2) Assemble the rudder bottom hinge bracket to the new spring tab mechanism and fit the spigot and bearings into the bottom hinge bearing housing. Ensure that the bearing housing is packed with grease (Chap.3).

(3) Secure the sealing plate over the bearing housing using two self-tapping screws and jointing compound Ref.No. 33H/2202110.

(4) At the access panel at rib 6 on the rudder nose, remove the two remaining bolts which secure the upper bearing bracket to the rib, and disconnect the tab control lever from the tab actuating rod. Remove the tab actuating lever and bearing housing complete. Pack upper bearing with grease (fig.18B).

(5) Offer up the assembly to the rudder and fit the bolts which secure the rudder bottom hinge bracket and stop bracket.

◀ (6) Manufacture a block to fit each side of the stop bolt, thus, centralizing the bolt in the kidney slot. With the actuator in the mid position refit it to the rudder and connect the tab actuator lever to the ram, adjusting the ram as required. Remove the blocks from the slot on completion of rigging. ▶

(7) Locate the tab actuating lever and upper bearing housing on to the splined end of the blow-back rod, and position

continued...

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KEY TO FIG. 21 (RUDDER SPRING TAB MECHANISM REMOVAL) - continued

it with the lever mid-way between its stops.

(8) With the tab set in its neutral position, reconnect the tab actuating rod to the tab actuating lever. Refit the four bolts which secure the upper bearing housing.

(9) Operate the tab, and check that the maximum travels quoted in fig.17 are obtained, and that the stops of the tab actuating lever are reached before the limit stop reaches the ends of the kidney slot.

(10) Ensure that no foul occurs between the sealing plate and the bolts which secure the main operating lever, when

the lever is moved through its complete travel.

(11) Through the existing holes in the tab-operating lever drill a 3/16 in. dia. hole in the splined end of the blow-back rod.

(12) Secure the tab-operating lever by using a new 2 B.A. nut and bolt, and the two existing saddle washers. Centre-punch to lock.

(13) Refit the access panels.

Note...

To obtain satisfactory locking, ensure that the screws, securing the access panel at rib 6 in the rudder nose, are of correct length (thread length 0.40 in.).

(14) Refit the rudder to the aircraft (Chap.3).

(15) Rig the rudder controls (fig.17).

Note...

1. Refer to para.26, Note 2.

2. The sequence for fitting a re-conditioned rudder spring tab mechanism Ref.No.26FZ/2102 is similar to the above, except that the drilling detailed in operation (10) will already have been done when the blow-back rod was fitted to its original rudder. Should it be necessary to misalign this hole relative to the hole in the tab actuating lever to obtain a condition of 'no foul', the misalignment must be corrected by drilling through with a 1/4 in. dia. drill, and fitting a larger bolt at operation (11).

Appendix I FLIGHT TRIM CHECKS

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IMPORTANT

◀ Whenever an aircraft component which affects longitudinal trim is replaced or adjusted, the flight trim checks specified in this Appendix are to be repeated. Should the aircraft trim be outside the limits specified, a new trailing-edge strip is to be fitted, and the flight trim checks and subsequent trailing-edge strip adjustments carried out. Components likely to affect longitudinal trim are:- Main plane(s), rear fuselage, tail plane(s), tail-plane actuator, ailerons, elevators, and aileron and elevator tabs. ▶

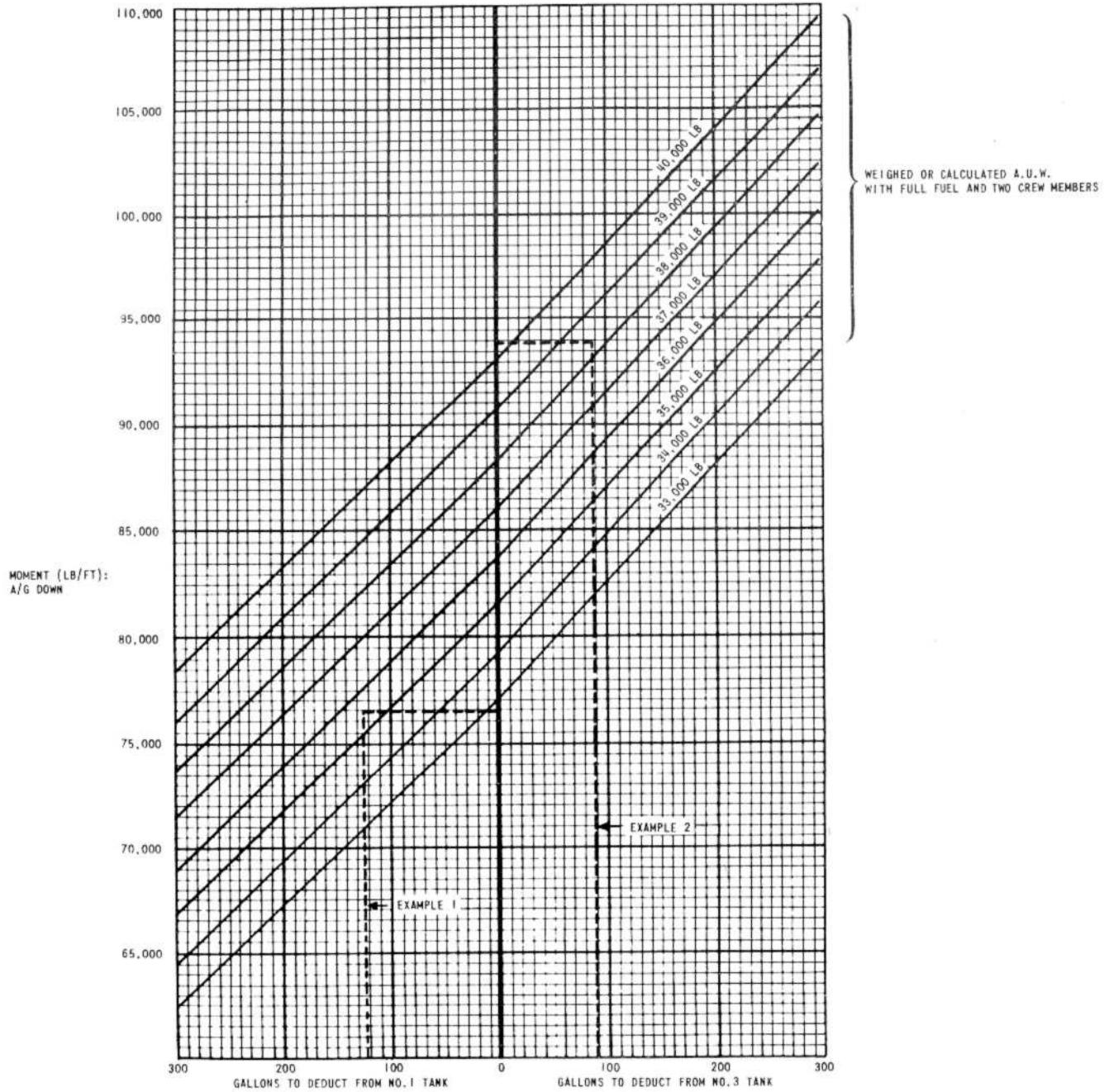


FIG. 1. FUEL LOAD DETERMINATION GRAPH

25% SMC + 1%

Introduction

1. This Appendix details the flight trim checks, and the subsequent trimming of the elevator trailing-edge strips, necessary to ensure that the aircraft trim is within the limits laid down, thus enabling the pilot to maintain control of the aircraft in any flight

condition within service limits, should the tail-plane actuator have run away to the maximum aircraft 'nose-down' position, i.e. the actuator on its mechanical stop.

Centre of gravity

2. During flight tests, the centre of

gravity is to be maintained at 2.285 ft \pm 0.15 ft aft of the c.g. datum. This is achieved by a predetermined distribution of the fuel load at engine 'start-up' which will allow for fuel consumed in taxiing, take-off, and climb to test altitude (up to 6000 ft). Two crew members only (pilot and navigator) are to be carried; wing-tip tanks, pods, and all military loads, must be removed.

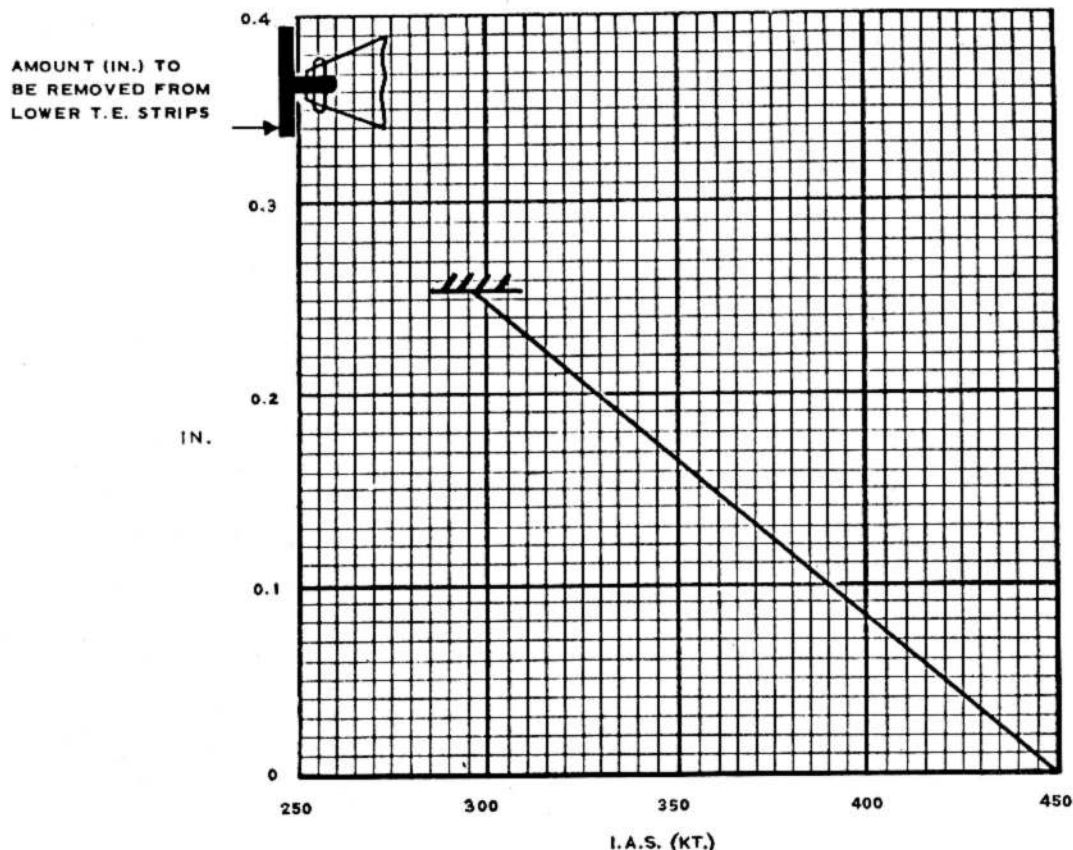
3. The weight and moment of the aircraft with alighting gear down, are to be determined with full fuselage fuel load and two crew (but no stores) by weighing, calculation, or reference to the current Form 4908. These values are used in conjunction with the graph (fig.1) to determine the reduction of the full fuel load at start-up in tanks 1 or 3 to ensure a correct c.g. position at the commencement of the test run.

Fuel load determination (fig.1)

4. The appropriate value of the aircraft moment is read from the vertical axis of the graph and a horizontal line is extended from this value to intersect the aircraft weight value at, or between, the weight lines. A vertical line dropped from this intersection to the horizontal axis of the graph indicates the amount of fuel to be removed from the relevant tank to give the correct trim at start-up.

Example 1 (fig.1)

Aircraft moment.....	76,500 lb ft
All-up weight.....	35,500 lb
Amount of fuel to be deducted	
from No.1 tank.....	125 gal
No.3 tank.....	Full



MAXIMUM I.A.S. AT WHICH AIRCRAFT CAN BE TRIMMED 'HANDS OFF' USING FULL AIRCRAFT NOSE-DOWN TRIM

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Fig.2. Lower trailing-edge strip adjustment

Example 2 (fig.1)

Aircraft moment 94,000 lb ft
 All-up weight 38,250 lb
 Amount of fuel to be deducted
 from No.3 tank 90 gal
 No.1 tank Full

Note. . .

A full load is to be maintained in No.2 tank.

5. The test run is to be commenced immediately the specified altitude is reached. No.1, 2 and 3 fuel tanks are to be used for warming up, taxiing, take-off and climbing to the test altitude. Thereafter only No.2 tank is to be used for the test.

Flight procedure

Note. . .

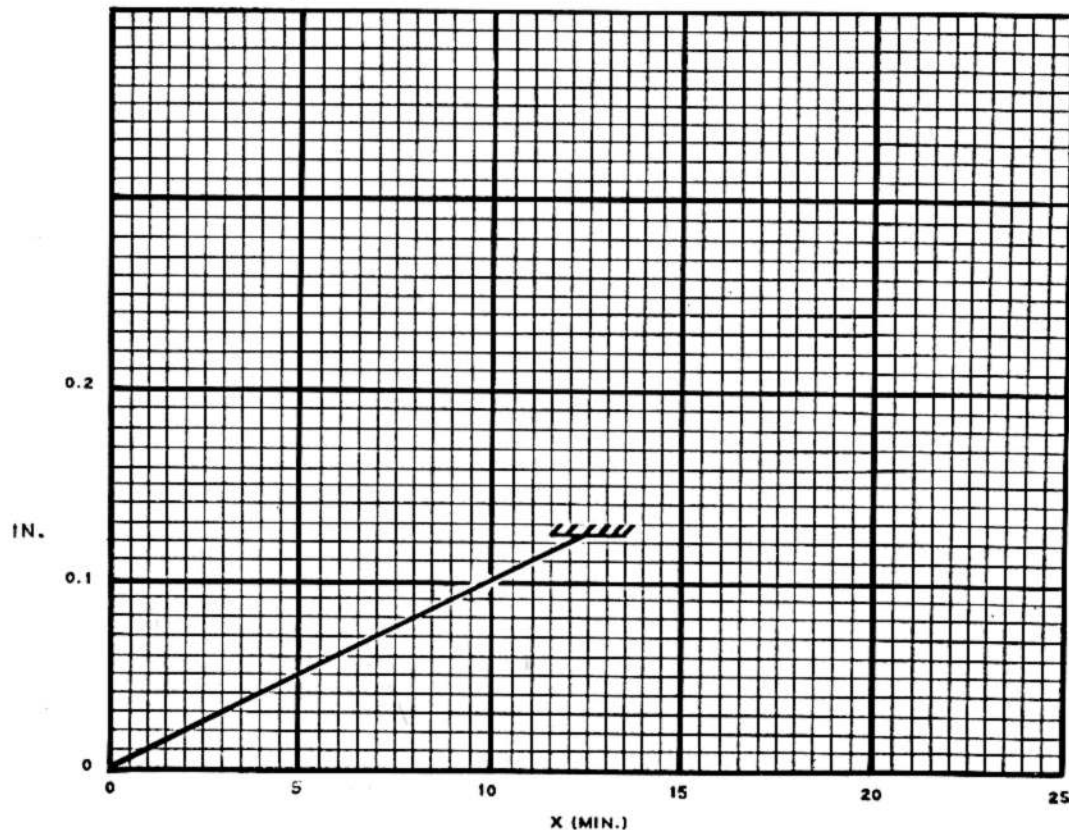
1. All speeds quoted are I.A.S.
2. The elevator trailing-edge strips Part No.EA1.31.677 are to be examined prior to the first flight and, if bent, kinked or damaged, are to be renewed. Bowing where the strip follows the line of the elevator edge is acceptable.
3. Over-adjustment of the trim will necessitate fitting a replacement strip and recommencement of the tests. It is therefore advisable to remove the strip in small stages.
4. The tests are to be carried out in calm air and good visibility.
5. When fitting a replacement trailing-edge strip, care must be taken to ensure that this strip is correctly aligned in the position vacated by the old strip.

6. Operating the fuel system as instructed, climb to the test altitude (1013

millibars setting), and increase speed slowly until:

- (1) Case 1 - The aircraft can just be trimmed 'hands-off' in level flight with

speed steady using full NOSE-DOWN trim. Record the speed. Increase the speed slowly beyond this point to ensure that a push force develops on the control column.



X = FULL NOSE-UP T/P ANGLE ON ELECTRICAL STOPS AS MEASURED BY INCIDENCE BOARD MINUS T/P ANGLE REQUIRED TO TRIM CLEAN A/C 'HANDS OFF' AT 450 KT.

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Fig.3. Upper trailing-edge strip adjustment

(2) Case 2 - If 450 knots is reached before the condition described in Case 1 is obtained, trim the aircraft 'hands-off' at 450 knots and, without further adjustment of the tail trimmer reduce speed slowly using elevator and throttle, and land the aircraft.

Note...

Care is to be exercised when reducing speed because a nose-down change of trim will generally occur as speed is reduced. The stick force to hold this change of trim may increase initially as speed is reduced, but will diminish below 350 knots. Lower the undercarriage at 190 knots, and the flaps at 160 knots. The pull force on the control column should be greatly reduced and may become a small push force when the flaps are lowered.

Adjustment procedure

Case 1

7.

(1) Read from fig.2 the amount of metal to be removed from the elevator strips according to the speed reached, and remove this amount from the depth of the lower strips on both elevators, along the whole length of the strips.

(2) Refuel the aircraft (para.4) and repeat the flight trim check (para.6(1)) and trailing-edge strip adjustment (1) as necessary until the following trim condition is achieved:

The aircraft can be flown 'hands-off' at a speed between 425 and 450 knots with full NOSE-DOWN trim applied.

Typical example - Consider an aircraft

which, on its first flight check can be flown 'hands-off' at 355 knots with full NOSE-DOWN trim.

Reference to the curve (fig.2) will show that 0.16 in. must be removed from the depth of the lower strips. After the second flight, and assuming that the aircraft is now in trim at 390 knots, remove a further 0.1 in. from the lower strips. If, on the third flight, the 'hands-off' trim speed, with full NOSE-DOWN trim applied, lies between 425 and 450 knots, the adjustment is satisfactory.

Note...

1. There is no restriction on the amount of lower strip which it is permissible to remove.

2. If, due to over-adjustment, the aircraft becomes 'Case 2', this condition is satisfactory providing the tail-plane setting at 450 knots is not more than 3 minutes from the tail-plane leading-edge UP electrical stop (refer to para.6(2) and 8(1) and (2) for the procedure in this case). If excessive over-adjustment has occurred, and the tail-plane setting at 450 knots is greater than 3 minutes from the tail-plane leading-edge UP electrical stop, the trailing-edge strip must be renewed and the tests recommenced. It is not permissible to remove metal from both the upper and lower strips.

Case 2

8.

(1) Place the aircraft on a level stand-

ing and support the fuselage with a trestle. Without disturbing the tail-trim setting, measure the tail-plane incidence (the angle found necessary to trim 'hands-off' at 450 knots).

(2) Without removing the clinometer, run the actuator on to its leading-edge UP electrical stop. Record the difference in angle between the 'hands-off' at 450 knots trim position, and the electrical stop.

(3) Read from fig.3 the amount of metal to be removed from the upper strips corresponding to the difference found in operation (2). Remove the required amount of metal from both elevators along the whole length of the strips.

(4) Refuel the aircraft (para.4) and repeat the flight check (para.6(2)) and trailing-edge strip adjustment (3) as necessary until the following trim condition is achieved:

The aircraft can be flown 'hands-off' at a speed of 450 knots with the tail-plane setting not more than 3 minutes from the leading-edge UP electrical stop.

Typical example - Consider an aircraft on which the tail-plane angle required to fly 'hands-off' at 450 knots was 3 deg 52 min and the electrical stop is found to be set at 4 deg, giving a difference of 0 deg 8 min.

Reference to the curve (fig.3) will show that 0.080 in. must be removed from the depth of the upper strips. Assuming that the 450-knots tail-plane

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setting is 4 minutes from the electrical stop on the second flight, a further 0.040 in; must be removed from the upper strips. If, on the third flight, the aircraft will fly 'hands-off' at 450 knots with the tail plane set at not more than 3 minutes from the leading-edge UP electrical stop, the trailing-edge strip adjustment is satisfactory.

Note. . .

1. The amount of metal that it is per-

missible to remove from the upper strips is restricted to half the depth of the strips.

2. *If, due to over-adjustment, the aircraft becomes 'Case 1', this condition is satisfactory provided that the aircraft can be flown 'hands-off' using full NOSE-DOWN trim at a speed of not less than 425 knots. If excessive over-adjustment has occurred resulting in a 'hands-off'*

trim speed of less than 425 knots using full NOSE-DOWN trim, the trailing-edge strips must be renewed, and the tests recommenced.

3. *When fitting a replacement trailing-edge strip, care must be taken to ensure that this strip is correctly aligned in the position vacated by the old strip.*

Appendix 2 FLIGHT TRIM CHECKS

(Aircraft restricted to 300 knots)

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IMPORTANT

Whenever an aircraft component which affects longitudinal trim is replaced or adjusted, the flight trim checks specified in this Appendix are to be repeated. Should the aircraft trim be outside the limits specified, a new trailing-edge strip must be fitted and the flight trim checks and subsequent trailing-edge strip adjustments carried out. Components likely to affect longitudinal trim are:- Main plane(s), rear fuselage, tail plane(s), tail-plane actuator, ailerons, elevators, and aileron and elevator tabs.

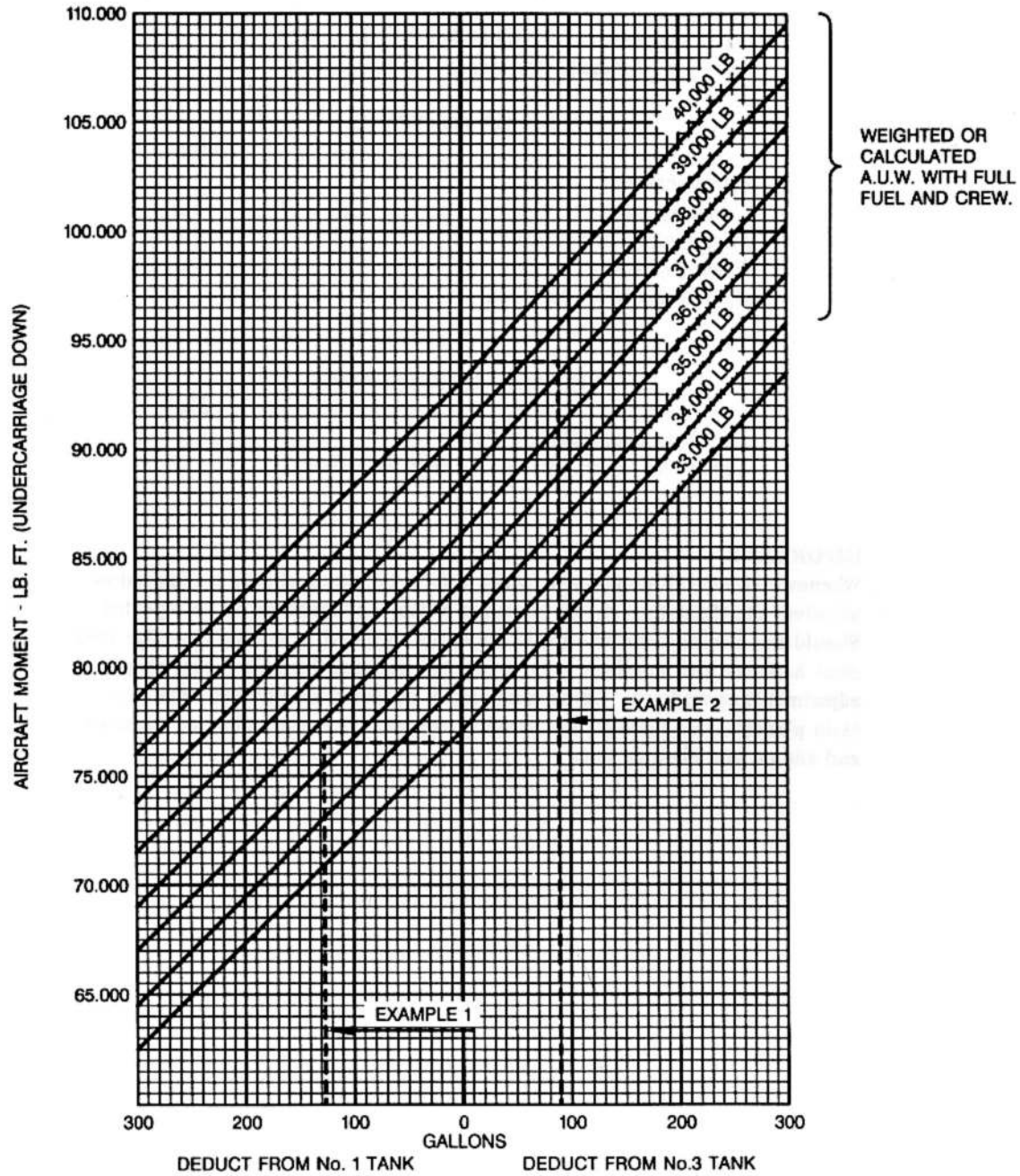


FIG.1. FUEL LOAD DETERMINATION GRAPH

Introduction

1. This Appendix details the flight trim checks, and the subsequent trimming of the elevator trailing-edge strips, necessary to ensure that the aircraft trim is within the limits laid down, thus enabling the pilot to maintain control of the aircraft in any flight condition within service limits, should the tail-plane actuator have run away to the maximum aircraft 'nose-down' position, i.e. the actuator on its mechanical stop.

Centre of gravity

2. During flight tests, the centre of gravity is to be maintained at 2.285 ft \pm 0.15 ft aft of the c.g. datum. This is achieved by a pre-determined distribution of the fuel load at engine 'start-up' which will allow for fuel consumed in taxiing, take-off, and climb to test altitude (up to 6000 ft). Two crew members only (pilot and navigator) are to be carried; wing-tip tanks, pods, and all military loads, must be removed.

3. The weight and moment of the aircraft with alighting gear down, are to be determined with full fuselage fuel load and two crew (but no stores) by weighing, calculation, or reference to the current Form 4908. These values are used in conjunction with the graph (fig.1) to determine the reduction of the full fuel load at start-up in tanks 1 or 3 to ensure a correct c.g. position at the commencement of the test run.

Fuel load determination (fig.1)

4. The appropriate value of the aircraft moment is read from the vertical axis of the graph and a horizontal line is extended from this value to intersect the aircraft weight value at, or between, the weight lines. A vertical line dropped from this intersection to the horizontal axis of the graph indicates the amount of fuel to be removed from the relevant tank to give the correct trim at start-up.

Example 1 (fig.1)

Aircraft moment	...	...	...	...	76,500 lb ft
All-up weight	...	...	...	...	35,500 lb
Amount of fuel to be deducted from No.1 tank	...	...	...	...	125 gal
No.3 tank	...	...	...	...	Full

Example 2 (fig.1)

Aircraft moment	...	...	...	...	94,000 lb ft
All-up weight	...	...	...	...	38,250 lb

Amount of fuel to be deducted from No.3 tank	...	...	...	...	90 gal
No.1 tank	...	...	...	...	Full

Note . . .

A full load is to be maintained in No.2 tank.

5. The test run is to be commenced immediately the specified altitude is reached. No.1, 2 and 3 fuel tanks are to be used for warming up, taxiing, take-off and climbing to the test altitude. Thereafter only No.2 tank is to be used for the test.

Flight procedure**Notes . . .**

(1) *All speeds quoted are I.A.S.*

(2) *Before the first flight test, the elevator trailing-edge strips Part No. EA1.31.677 should be examined and, if they are bent, kinked or damaged, should be removed and new strips fitted. Bowing where the strip follows the line of the elevator edge is acceptable.*

(3) *It is better to remove too little trailing-edge strip since, if the aircraft trim is over-adjusted, a new strip will have to be fitted and the tests re-commenced.*

(4) *Take-off and climb should be normal on all three tanks, but the actual trim checks should be carried out on No.2 tank only, with No.1 and 3 tanks switched off.*

(5) *Tests are to be carried out in calm air and good visibility.*

(6) *When fitting a new trailing edge strip, care must be taken to ensure that the new strip is correctly aligned in the position vacated by the old strip.*

6. Operate the fuel system as instructed in Note 4 and climb to test altitude (1013 millibars setting).

(1) Trim the aircraft 'hands-off' at 300 knots.

(2) Provided the trim gauge shows the tailplane trim to be in the air-

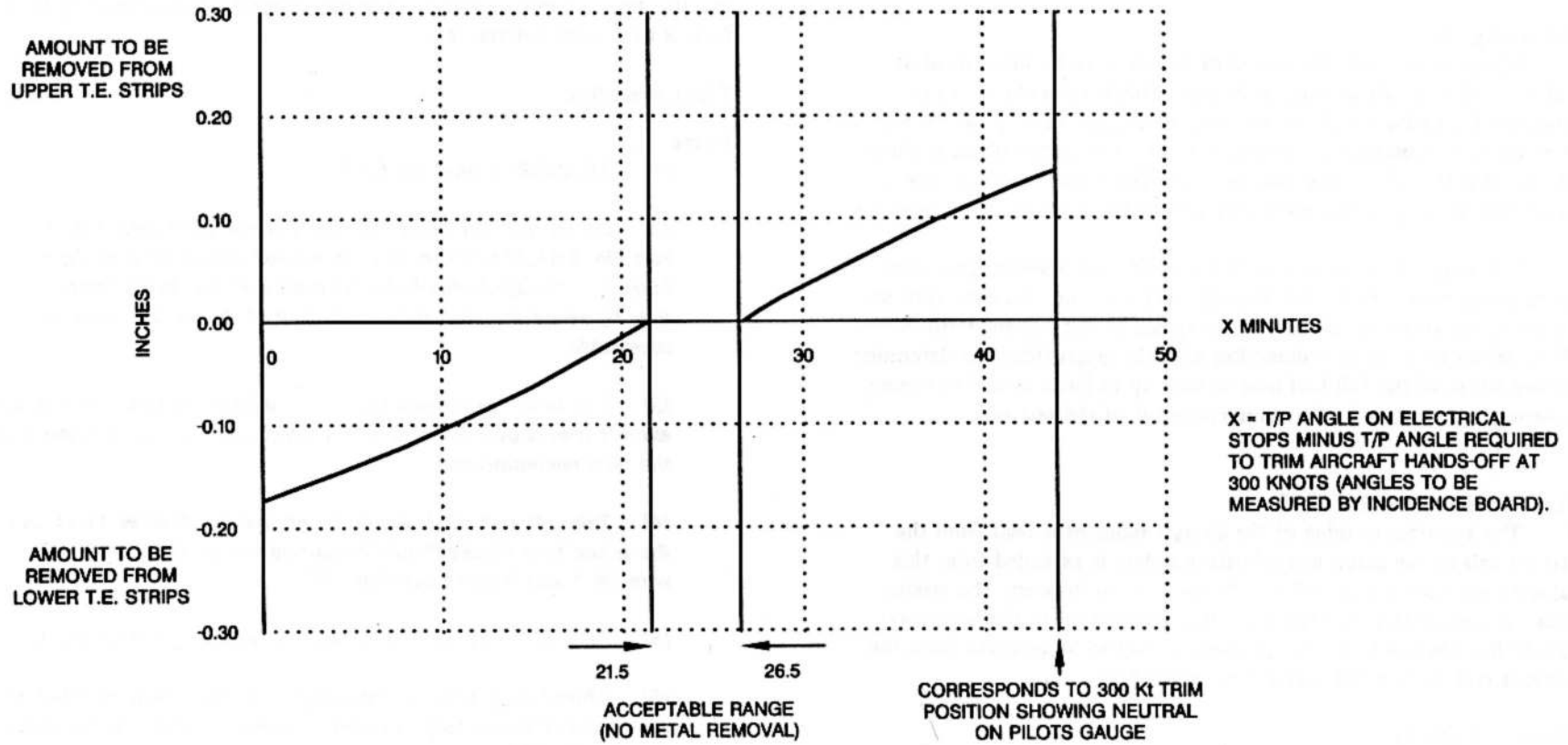


FIG.2. UPPER AND LOWER TRAILING EDGE STRIP ADJUSTMENT

craft nose down sense, land the aircraft without further adjustment of the tail trimmer.

Note . . .

Care should be exercised when flaps are lowered, since the requirement to avoid re-trimming will generate the need for an extra push/lesser pull force on the control column. For the worst combination of tailplane set-up tolerance possibilities, at 160 knots, the additional push force is not expected to exceed 26 lbs. More typically the extra push force is expected to be half this value. This additional force will reduce significantly as speed is decreased.

(3) In the unlikely event that the trim gauge shows the 300 knot position to be in the aircraft nose-up sense, land the aircraft using the tail trimmer as normal. This action removes the possibility of the push forces being unacceptably large when the flaps are lowered. Remove 0.07 in. of metal from the port and starboard upper strips, along the whole length of the strip. Recommence the tests as per (1) above. If the 300 knots trim position still results in a nose-up indication on the trim gauge, again land the aircraft using the trimmer normally. Advice should be sought from the design authority prior to any subsequent flying.

Adjustment Procedure

7. Refer to Fig.2

(1) Place the aircraft on a level standing and support the fuselage with a trestle. Without disturbing the tail trim setting measure the tailplane incidence (this was the angle necessary to trim the aircraft 'hands-off' at 300 knots).

(2) Without removing the clinometer, run the actuator to it's leading edge up electrical stop. Record the difference in angle between the 300 knot trim position and the electrical stop.

(3) Read off the amount of metal to be removed, if any, from either the upper or lower strips corresponding to the difference found in operation (2). Remove the required amount of metal from both port and starboard elevators along the whole length of the strips.

(4) Refuel the aircraft (para.4) and repeat the flight check (para.6 (1

and 2)) and tail end adjustment (3) until the difference found in operation (2) lies within acceptable limits.

Typical example

Consider an aircraft on which the tailplane angle required to fly 'hands-off' at 300 knots was 3 deg 48 minutes and the electrical stop is found to be set at 4 deg giving a difference of 0 deg 12 minutes.

Reference to the curve (Fig.2) will show that 0.086 in. must be removed from the lower strips. Assuming that on the second flight the difference changes to 0 deg 20 minutes then a further 0.015 in. must be removed from the lower strips. If, on the third flight, the tailplane setting proves to be within 21.5 minutes to 26.5 minutes from the electrical stop, the trailing edge strip adjustment is satisfactory.

Notes . . .

1. *The amount of metal that can be removed from the upper strips is limited to half the depth of the strips.*

2. *There is no restriction on the amount of lower strip which may be removed; the whole of the lower strip may be removed if necessary.*

3. *It is not permissible to remove metal from both the upper and lower strips. Thus if over-adjustment has occurred the appropriate trailing edge strips should be removed and the tests recommenced.*

4. *When fitting a new trailing edge strip, care must be taken to ensure that the new strip is correctly aligned in the position vacated by the old strip.*

Chapter 5 ALIGHTING GEAR

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	Chapter
MAIN UNDERCARRIAGE... ..	5A
NOSE UNDERCARRIAGE... ..	5B

Note... A detailed list of contents will be found at the beginning of each chapter.

INTRODUCTION

1. Because of its bulk, this chapter is divided into sub Chapters A (main undercarriage) and B (nose undercarriage). Each sub chapter describes, and illustrates in detail, the mechanics and disposition of the major components, the servicing operations and the major removal and assembly procedures.

2. The tricycle alighting gear consists of two main units which retract inward into bays in the main planes and a single nose unit which retracts rearward into a bay in the nose fuselage aft of the pressure bulkhead. Each main undercarriage has a single wheel mounted on an inward-facing stub axle incorporating Dunlop hydraulic 'copper plate'

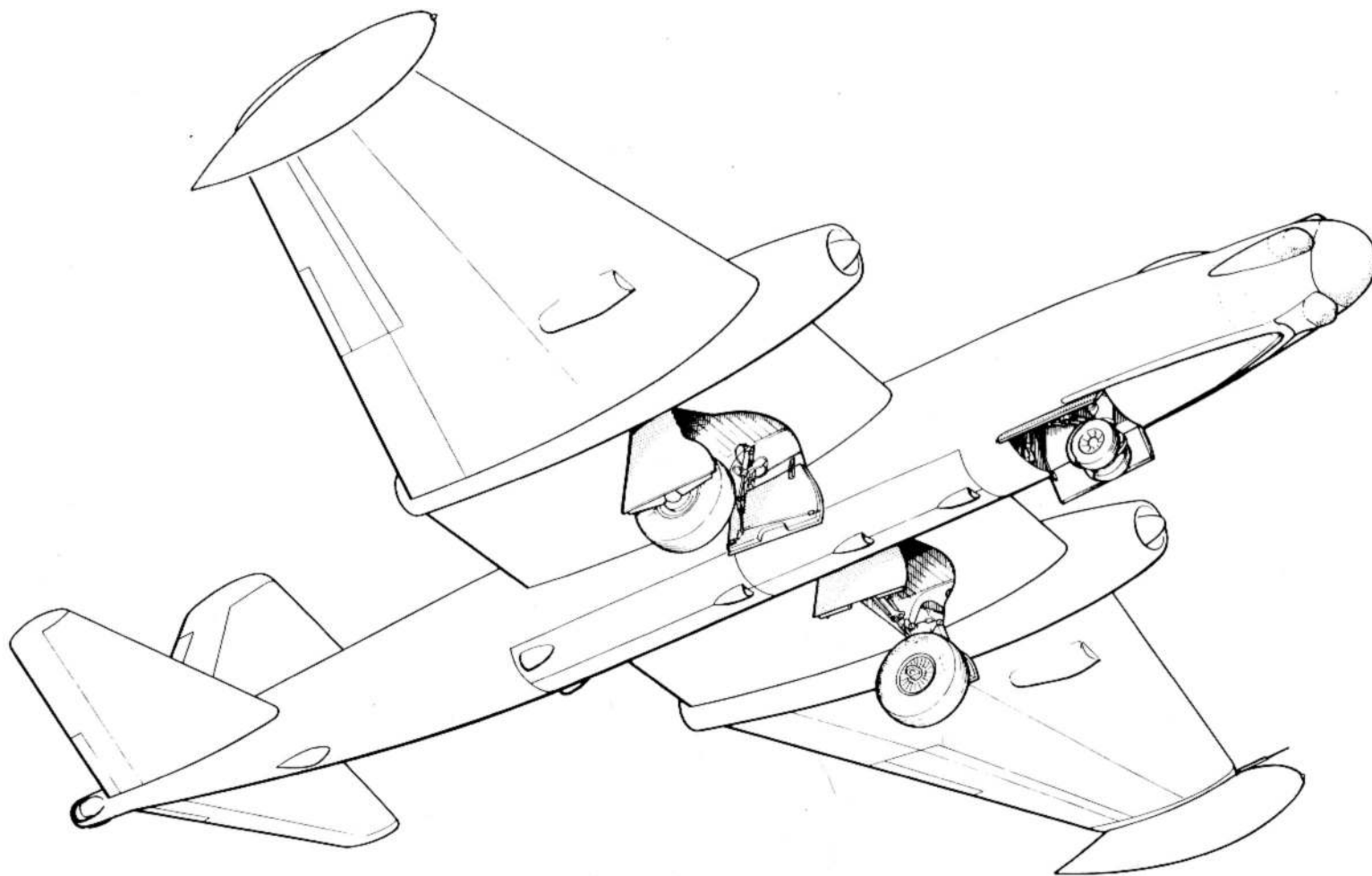
type brake units fitted to each wheel. To reduce shimmy, the nose undercarriage is fitted with twin wheels; these are smaller in diameter than the main wheels and are mounted on a common axle. Mud guards, fitted over both wheels, protect the interior of the nose-wheel bay.

3. Movement of the alighting gear is effected by hydraulic jacks (Chap.6) which are electrically controlled by selector push-buttons mounted on the alighting gear sloping panel on the port side of the instrument flying panel. Indicator lights, which show GREEN 'locked down' and RED 'unlocked', are mounted on the same panel adjacent to the selector push-buttons. Provision

is made for an override UP selection; this is accomplished by clockwise rotation of the knobbed ring of the UP push-button, followed by depression of the button (Sect.3, Chap.11, para.16). Undercarriage DOWN emergency selection is made by pulling the black-and-yellow painted handle protruding above the alighting gear sloping panel (Chap.11).

4. The apertures into which the alighting gear retracts are sealed upon completion of retraction by flush-fitting doors operated by hydraulic jacks. Correct retraction and lowering sequence is ensured by the incorporation of sequence valves in the hydraulic circuit, details of which are given in Chapter 6.

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ALIGHTING GEAR

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Chapter 5A MAIN UNDERCARRIAGE

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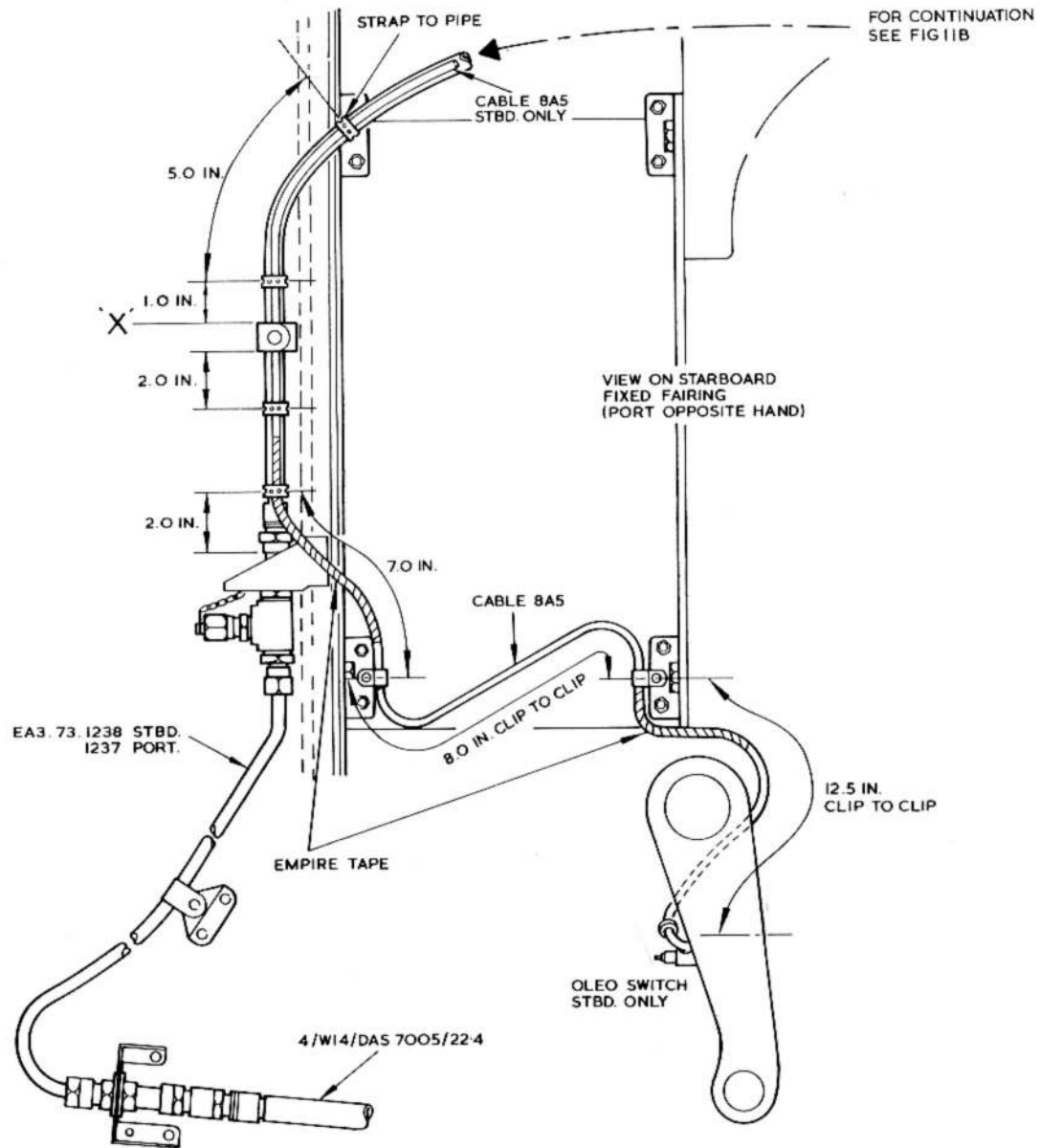


FIG. II A. UNDERCARRIAGE - PIPING AND WIRING INSTALLATION

◀ NEW ILLUSTRATION ▶

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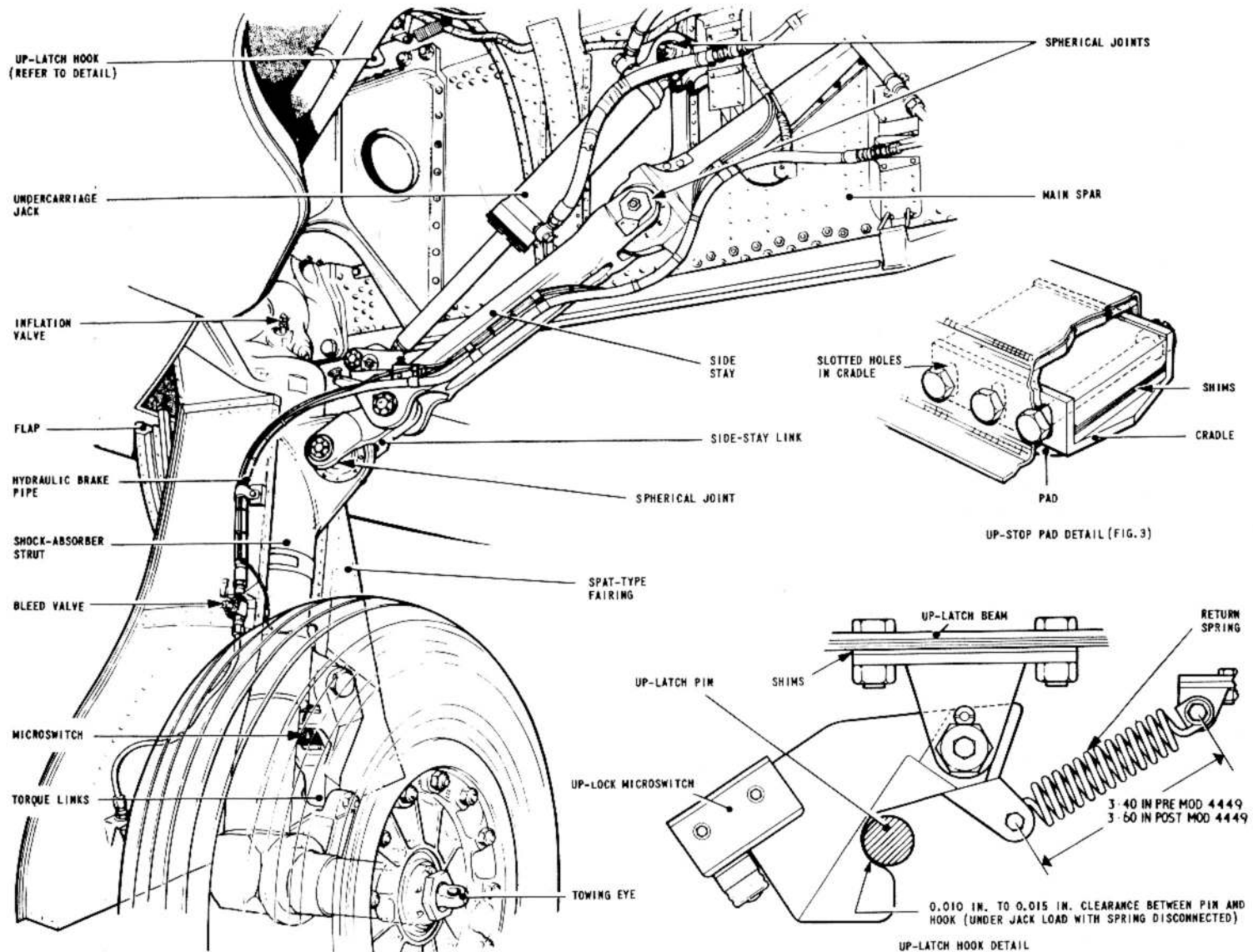


FIG. I. STARBOARD UNDERCARRIAGE

MOD 4449 EMBODIED

DESCRIPTION**General information (fig.1)**

1. Each main undercarriage consists of a cantilever shock-absorber strut of the oleo pneumatic type, carrying a single wheel and retracting inwards into the main plane. In the down position the shock-absorber is braced against side loads by a knuckle-jointed side stay (*para.3*) which incorporates the undercarriage down-lock mechanism. The undercarriage jack is attached by a spherical joint to the main-plane structure and to the lock lever assembly on the side-stay assembly down-lock mechanism (*fig.6*). Spat-type fairings are attached to the shock absorber struts to fair off the undercarriage housing when the undercarriage is retracted. The unit is fully described in A.P.1803P, Vol.1, Sect.6, Chap.4.

Shock-absorber struts

2. Each shock-absorber strut is suspended by its main pivot from large bearing bracket lugs on the front face of the main-plane main spar, one on each side of the engine inboard rib. The struts consist of two cylinders sliding one within the other, two pistons operating one within each cylinder, and an axle which is formed at the base of the inner cylinder or sliding tube. Torque links hinged to lugs on both inner and outer cylinders form a scissors-like connection between the two cylinders and transmit the torque loads from the wheel to the outer cylinder, thus preventing rotation of the sliding tube. An adapter, fitted with an oil

level tube and an inflation valve, is fitted into the head of the outer cylinder.

Side stay (fig.6)

3. The side-stay assembly consists of a side stay, a side-stay link, and the undercarriage down-lock mechanism. The stay and stay link are hinged together and the hinge bolt is offset below the centre-line of the assembly; this ensures that the loading on the side stay will tend to fold it downwards, though this is resisted by a stop bolt fitted on the stay which butts against a buttress formed on the upper face of the stay link. The upper end of the side stay is attached by a spherical joint to a bracket on the front face of the main spar, and the lower end, which is the stay link fork, is attached to the spherical bearing lug on the shock-absorber strut. The side stay carries the pick-up point for the hydraulic jack piston-rod, the lock lever and rollers, the down-lock microswitch, up-latch pin, and an adjustable tappet for operating the door jack sequence valve.

Up-lock mechanism (fig.3)

4. The up-lock hook is mounted on the main-plane structure in the roof of the wheel well and is held in the engaged position by a coil spring. The underface of the hook is so shaped that when the up-latch pin in the side stay contacts it during retraction, the hook pivots to permit the pin to pass and then, under the influence of its spring, snaps back to its original position, engages the pin and retains the undercarriage in the retracted position. The

UP indicator lights are actuated by the upper surface of the side-stay fork which contacts a microswitch mounted on the up-lock hook.

5. When undercarriage DOWN is selected the initial movement of the jack releases the lock. The bolt connecting the eye-end of the jack piston rod to the side stay is fitted in slotted holes in the side-stay fork and moves across the holes as the jack extends. The eye-end of the jack contacts the end of the hook and, a protrusion above the centre-line of the eye, pushes the hook out of engagement. The undercarriage falls under gravity for the first part of its travel during which time the jack attachment bolt is returned to its former position. As the undercarriage approaches the down position, hydraulic pressure in the jack straightens the side-stay assembly and pushes the down-lock lever into engagement with the hooked end of the side-stay link (*fig.6*).

Down-lock mechanism (fig.3)

6. The down-lock mechanism consists of a lever, pivoted on the up-latch pin in the side stay, which is moved into position against the lip on the end of the stay link by the action of the undercarriage jack; it is retained in position by a spring-loaded stop in the side stay. A flanged plate lever is attached to the pivot bolt and the jack attachment bolt so that it moves with the lock levers and depresses the plunger of a microswitch which operates the undercarriage DOWN indicator lights. When undercarriage UP is selected, the

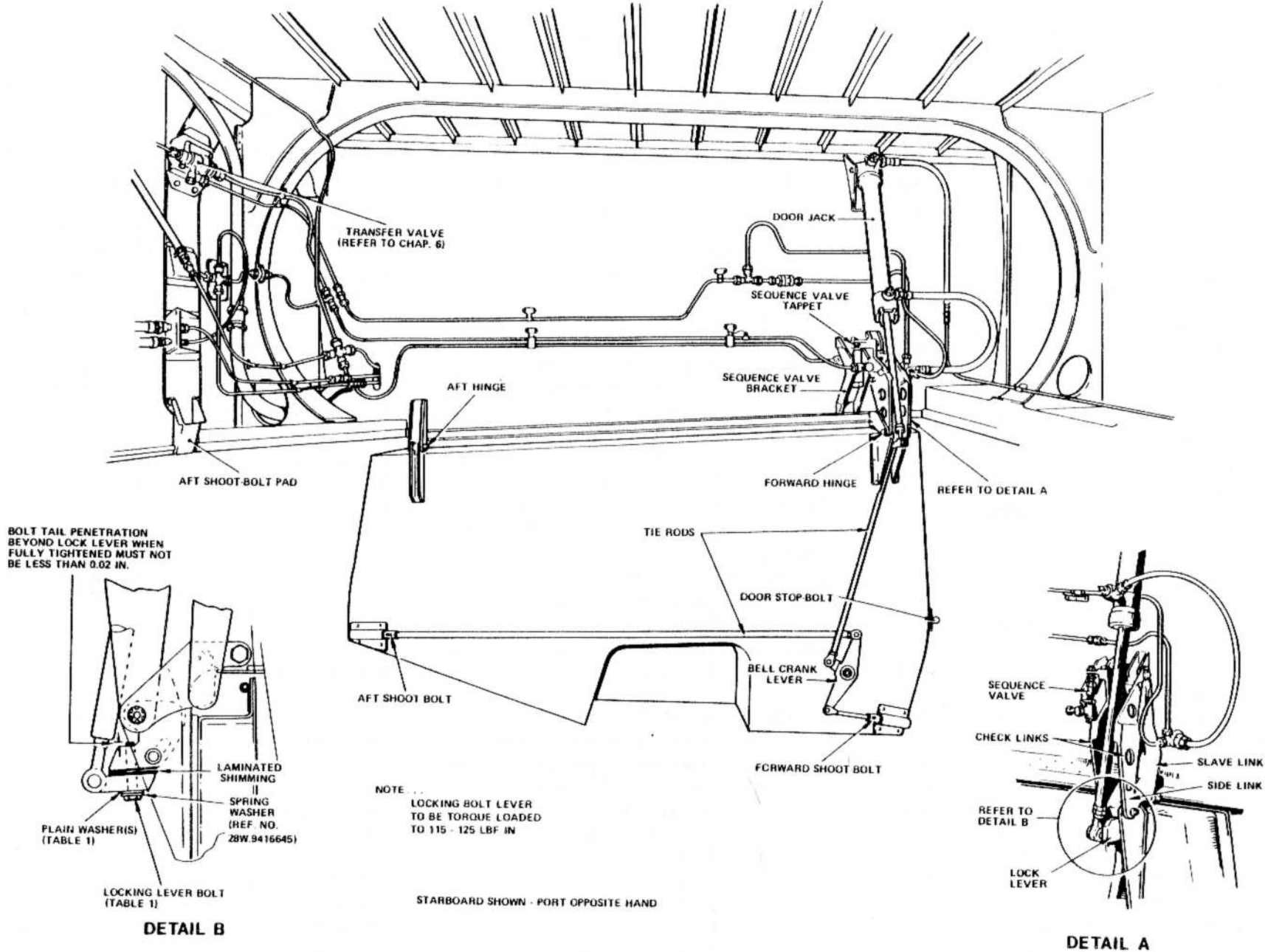


FIG.2. MAIN UNDERCARRIAGE DOOR-OPERATING MECHANISM

◀TORQUE LOADING NOTE ADDED TO LOCKING LEVER BOLT▶

initial movement of the jack moves the down-lock lever out of engagement with the lip of the stay link and unlocks the unit.

Door-operating mechanism (fig. 2 and 4)

7. The main undercarriage doors open downwards and inboard on two hinges attached to the fuselage side. Jointed check links, which abut when the doors are fully open, are attached to the lugs of the forward hinge; the upper check link carries a trip lever with an adjustable tappet which operates the undercarriage down sequence valve. This valve is positioned so that the door must be fully down and open before the trip lever tappet strikes it and allows hydraulic pressure to the down side of the main undercarriage jack. In the event of a mechanical failure of the check links the sequence valve is operated by an inboard movement of the undercarriage door in the airstream beyond its normal fully-open position; this further movement is transmitted to the sequence valve by a slave link mechanism attached to the door and the upper check link. The door jack is mounted vertically downwards between brackets on the fuselage skin with its piston-rod attached to a lock lever between the door forward hinge bracket lugs. On contraction of the jack the door is first retracted and, when fully up, the lock lever rotates through a small arc and operates a tie-rod, the movement of which is redirected through a bell-crank lever to two further tie-rods which operate the door latch shoot-bolts. When undercarriage DOWN is selected the jack operates the lock lever

and the shoot-bolts are withdrawn as the first operation.

Engine cowl flap

8. A small flap, the movement of which is restricted by a check cable, is situated in the engine lower cowling and is mechanically connected to the undercarriage main pivot by an adjustable tie-rod. The flap allows the main undercarriage leg, when lowered, to move outboard into a recess in the skin of the engine cowling and, on retraction, fits in the recess and fairs off the cowling.

Transfer valves

9. A transfer valve installed in each main undercarriage hydraulic circuit, allows fluid expelled from the up side of the hydraulic jack during lowering of the undercarriage to be diverted to the down side, thus reducing the lowering time. The additional supply of fluid assists the pumps to meet the immediate demands of the undercarriage circuit, ensuring a smooth continuous lowering and preventing cavitation in the main jacks. This transfer is especially effective when an emergency lowering has to be made as the extra fluid provided for the jack down stroke reduces the number of strokes required on the aircraft hand pump. When the undercarriage is retracted the transfer valves close, ensuring that the pump supply is confined to the up side of the jack only. Each valve incorporates a thermal relief valve which, in abnormal temperatures and pressures will relieve from the 'up' line to the 'down' line when the sequence valve is open.

Full details and servicing of the transfer valves are given in A.P. 1803D, Book 3A, Sect. 9, Chap. 67.

Principle of operation (fig. 3)

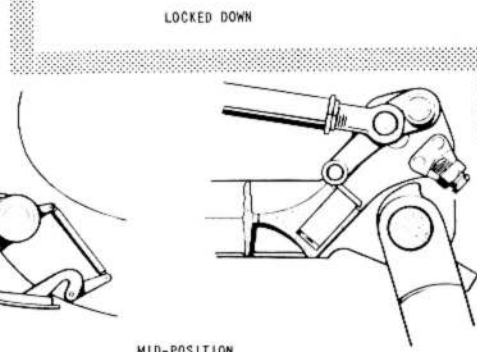
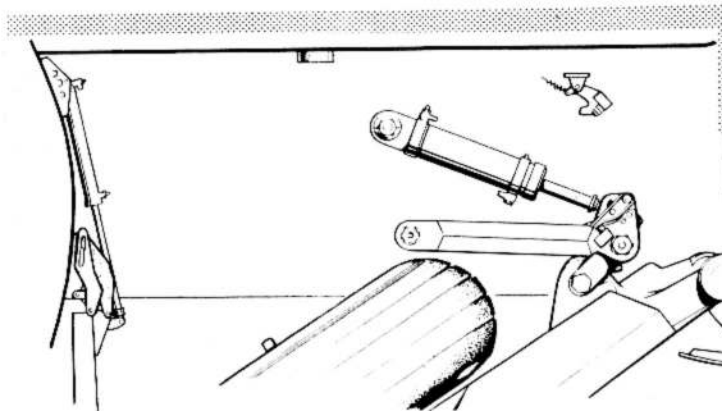
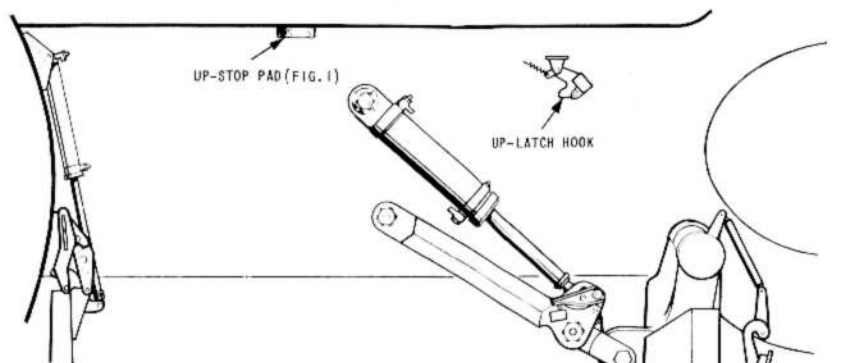
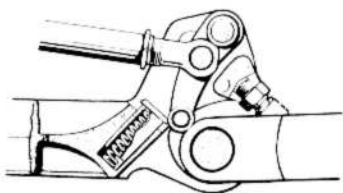
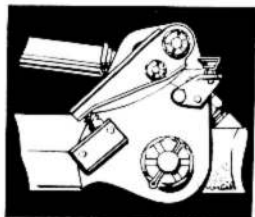
Raising

10. When the undercarriage is selected UP, hydraulic pressure is felt simultaneously on the 'up' side of both the undercarriage and undercarriage door jacks, but, as the door jack sequence valve is closed, preventing a return flow of fluid from the door jack, only the undercarriage jack operates. The initial movement pulls the jack pivot bolt back along the slot in the end of the side stay and moves the down-lock lever out of engagement with the lip of the stay link. Continued retraction raises the unit and at the same time closes the mechanically-operated flap in the engine cowling (para. 8). Final contraction of the main jack engages the up-latch pin with the up-latch hook in the roof of the wheel well and brings a trip tappet on the side stay into contact with the plunger of the door jack sequence valve. The door jack sequence valve is now open allowing hydraulic pressure on the 'up' side of the jack to raise the door. During its retraction the jack folds the check links (fig. 4) closes the undercarriage main jack sequence valve, and finally locks the door in its closed position by operating the shoot-bolts.

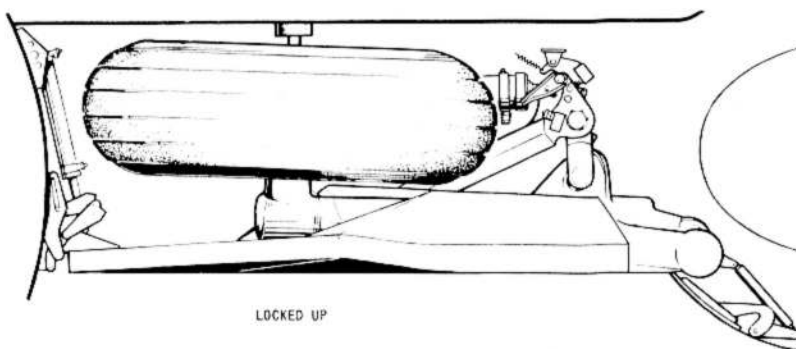
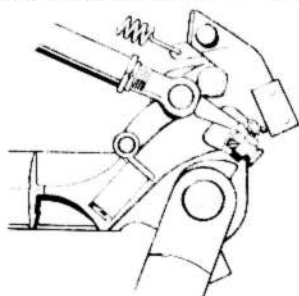
Lowering

11. Upon application of hydraulic power to lower the undercarriage, pressure is applied to both the undercarriage and

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MID-POSITION



LOCKED UP

FIG. 3. MAIN UNDERCARRIAGE/DOOR OPERATION

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undercarriage door jacks, but since the undercarriage jack sequence valve is closed, preventing the flow of fluid from the undercarriage jack, only the door jack is operated. Initial extension of the door jack disengages the door shoot-bolts against the action of their springs and continued movement of the jack piston-rod opens the door and finally brings the sequence valve trip lever tappet on the door check links into contact with the undercarriage sequence valve plunger. With the sequence valve open, hydraulic power can now op-

erate the undercarriage jack, and its initial movement releases the unit from the up-lock hook and closes the door sequence valve, locking the door jack in its extended position. For the first part of its travel the undercarriage falls under gravity, over-running the hydraulic pressure but, as it approaches the down position, hydraulic pressure builds up, straightens the side stay and link, and pushes the down-lock lever into position against the lip on the end of the stay link, locking the undercarriage down.

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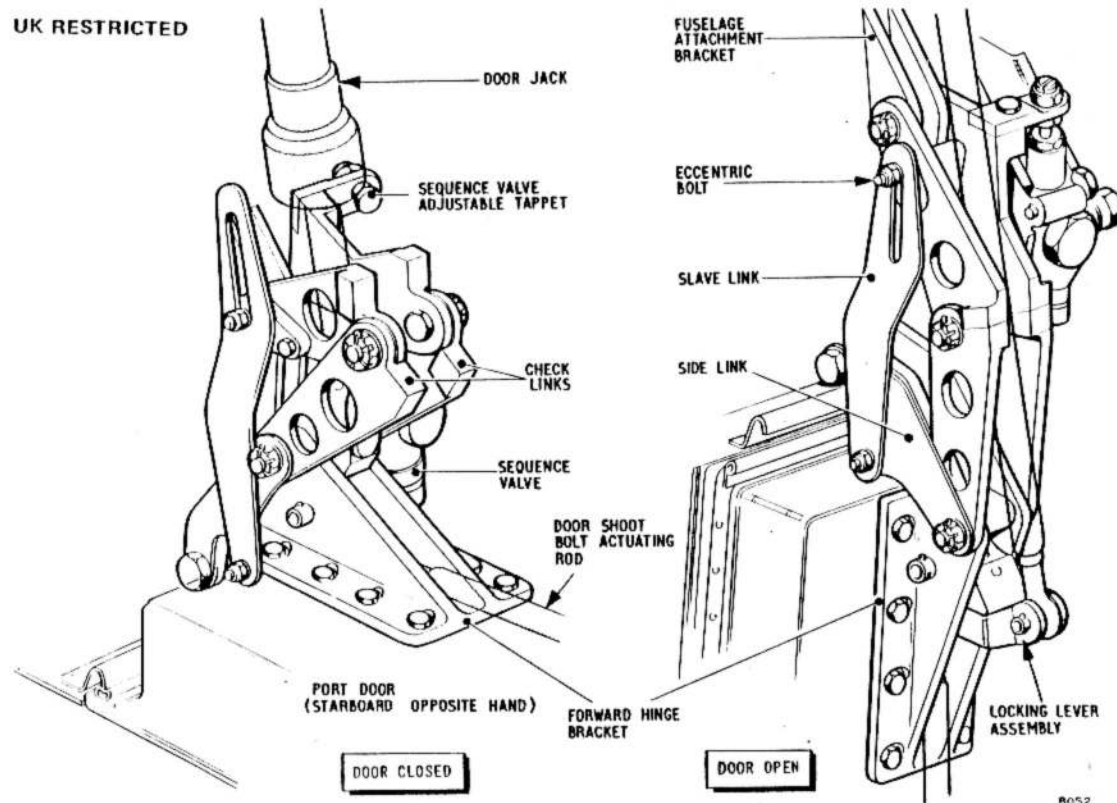


Fig. 4. Undercarriage door-operating mechanism

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

General information

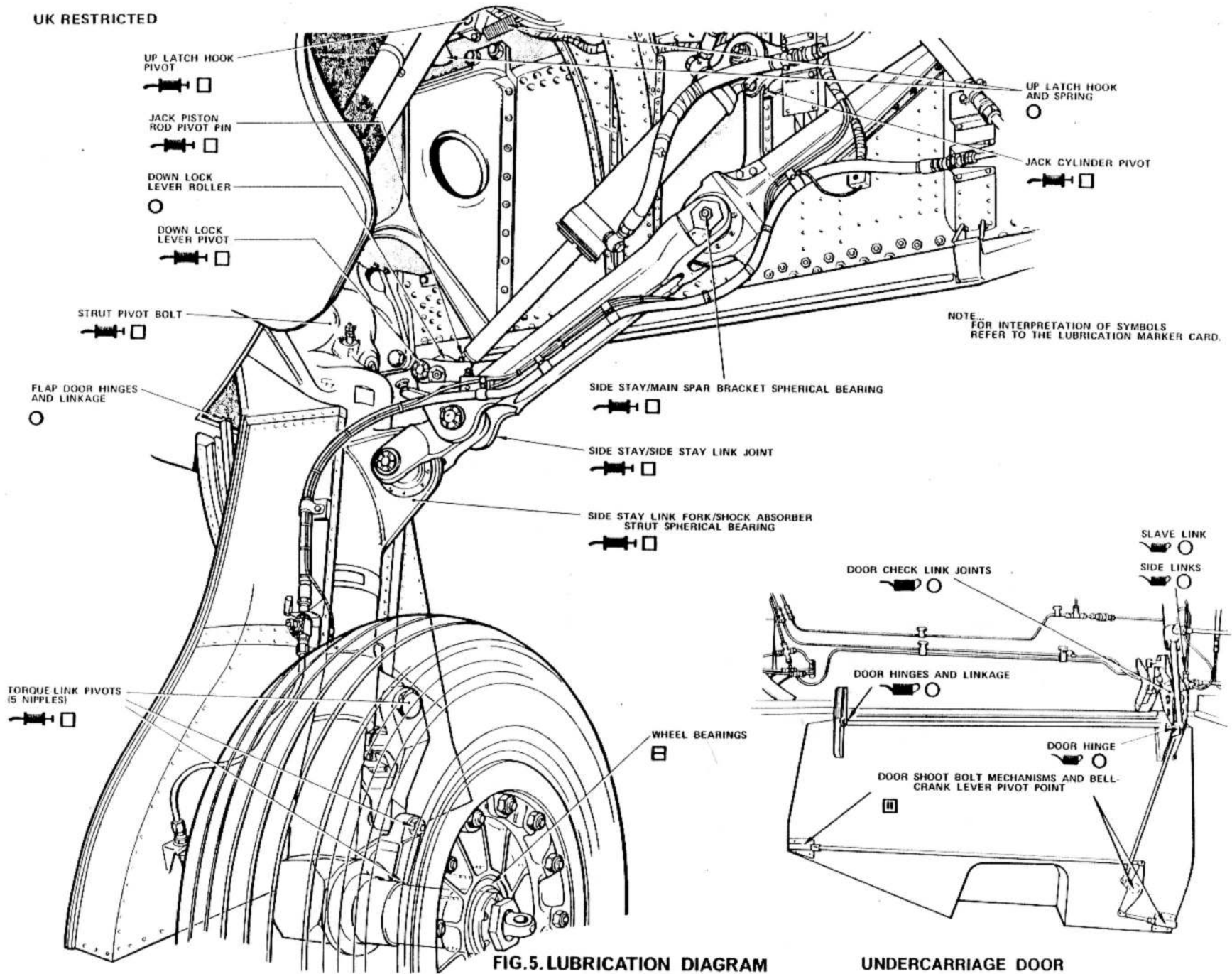
12. The following paragraphs provide information on checking and correcting the oleo legs oil level and nitrogen pressure.

Checking and correcting oil level

13. An inflation adapter Ref.No.4G/6246 fitted with a pressure gauge Ref.No.4G/3028 is used when checking and correcting the oil level. The following procedure must be adopted:-

- (1) Jack and trestle the aircraft (Sect. 2, Chap.4).
- (2) Ensure that the adapter nitrogen release valve is closed by turning the knurled knob as far as it will go in a clockwise direction.
- (3) Carefully turn the gauge counter-clockwise until the stop is reached; do not strain against the stop.
- (4) Tighten the cap at the adapter inflation point to prevent nitrogen escaping.
- (5) Remove the cap from the inflation valve at the top of the shock-absorber strut and screw on the adapter assembly, taking care not to disturb the position of the gauge.

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◀ (6) Bleed off the nitrogen pressure to zero through the nitrogen release valve in the adapter. ▶

(7) With the release valve still open, compress the leg fully, using a pillar jack Ref. No. 4Q/1045837, adapter Ref. No. 4Q/4230661 and bracket Ref. No. 26FZ/4161090.

(8) Close the inflation valve by rotating the gauge in a counter-clockwise direction, and close the adapter nitrogen release valve. ▶

(9) Remove the cap from the adapter inflation point, and correct an oleo charging pump Ref. No. 4G/4420003 to the inflation point.

(10) Open the undercarriage inflation valve and pump in hydraulic fluid OM-15, allowing the leg to extend by gradually lowering the pillar jack until the sliding tube of the shock-absorber strut is exposed to the extent of between one and two inches. Close the undercarriage inflation valve, disconnect the oleo charging pump and refit the cap on the inflation point.

(11) Open the undercarriage inflation valve and expel the excess fluid, compressing the undercarriage leg by means of the pillar jack. Close the inflation valve.

Note . . .

1. If no fluid is expelled, repeat operations (7) to (11).

2. Pillar jacks should be raised slowly and carefully to ensure that only excess fluid is expelled.

(12) Carry out operations detailed in para.14. The correct inflation pressures for varying all-up weights are given in Sect.2, Chap.2.

◀ **Checking and correcting nitrogen pressure**

14. An inflation adapter Ref.No.4G/6246, fitted with a 0-2500 lb/in² pressure gauge Ref.No.4G/3028, is used when checking and correcting the oleo leg inflation pressure. A full description of the inflation adapter, and general instructions for use are given in A.P.1464G, Vol.1, Part 2, Sect.5, Chap.10. Before checking the nitrogen pressure, note the following:- ▶

◀ (1) Correct nitrogen pressure is dependent upon a correct oil level (para.13). ▶

(2) The oleo leg must be fully extended.

(3) The strut inflation valve is the non-return type, therefore a reading will be obtained on the adapter gauge without slackening the valve.

◀ *To check and correct the nitrogen pressure:*

(1) Jack and trestle the aircraft (Sect.2, Chap.4).

(2) Ensure that the adapter nitrogen release valve is closed by turning the knurled knob clockwise as far as it will go. ▶

(3) Carefully turn the gauge counter-clockwise until the stop is reached; do not strain against the stop.

(4) Tighten the cap at the adapter inflation point.

(5) Remove the cap from the inflation valve at the top of the shock-absorber strut and screw on the adapter assembly, taking care not to disturb the position of the gauge.

(6) Turn the gauge clockwise until the stop is reached and a reading obtained. For related inflation pressure/all-up-weight figures refer to Sect.2, Chap.2.

(7) Should the gauge indicate more than the required pressure, ▶
◀ release nitrogen through the nitrogen release valve until the correct pressure is indicated.

When nitrogen pressure is low: ▶

(8) Turn the gauge in a counter-clockwise direction until the stop is reached.

◀ (9) Connect a high-pressure nitrogen charging trolley Ref.No.4G/5888 to the inflation point of the adapter. ▶

(10) Turn the pressure gauge clockwise until the stop is reached.

- ◀ (11) Introduce nitrogen into the oleo leg until the required pressure is indicated on the gauge.
- (12) Shut off the nitrogen supply.
- (13) Turn the gauge counter-clockwise until the stop is reached.
- (14) Disconnect the nitrogen supply connection from the adapter inflation point. ▶
- (15) Remove the inflation adapter from the inflation valve and refit the blanking cap.
- (16) Lower the aircraft to the ground and remove the jacks and trestles.

Lubrication

- 15. Refer to fig.5.

ADJUSTMENTS

General information

16. The following paragraphs describe the procedure to be adopted when settings have to be checked and adjustments made. These occasions arise during both servicing and assembly operations. After any adjustments have been made, the undercarriage must be function-tested.

Side-stay and stay-link alignment (fig.6)

17. The side stay and stay link are correctly aligned when the joint pin is offset downwards approximately 0.30 in. measured from a straight line between the side-stay pin centre and the stay-link spherical-joint centre. This off-set is adjusted during initial assembly by setting the clearance between the down-lock lever roller and the stay-link lip at

0.004 in. Should it be found necessary to adjust the offset:—

- (1) Jack and trestle the aircraft (*Sect.2, Chap.4*).
- (2) Remove the pivot pin attaching the jack piston-rod to the down-lock lever and retract the jack.
- (3) Apply an upward force to the underside of the side stay until the roller on the down-lock lever is bearing hard against the stay-link lip. Adjust the side stay stop-bolt until the clearance between the stop-bolt and its abutment face on the stay link measures 0.004 in. Tighten and wire-lock the stop-bolt locknut.
- (4) Release the force applied to the underside of the side stay when it will be noted that the 0.004 in. clearance now exists between the roller on the lock lever and the stay link lip. This can be checked by depressing the spring-loaded stop in the side stay and inserting a 0.004 in. feeler gauge between the lock-lever roller and the stay-link lip.
- (5) Extend the jack and refit and lock the pivot pin attaching the jack piston-rod to the down-lock lever.

Jack settings

Main jack

18. The distance between the pin centres of the main jack when fully closed must not exceed 20.63 in. \pm 0.25 in: the jack piston rod travel is 11.22 in. \pm 0.045 in. The exact pin centre dimension is governed by the pick-up points on the aircraft structure and side stay down-lock lever. The centres must be checked following renewal, replacement, or after any servicing which may have affected its setting. The length of the jack is adjusted in the following manner:—

- (1) Jack and trestle the aircraft (*Sect.2, Chap.4*).

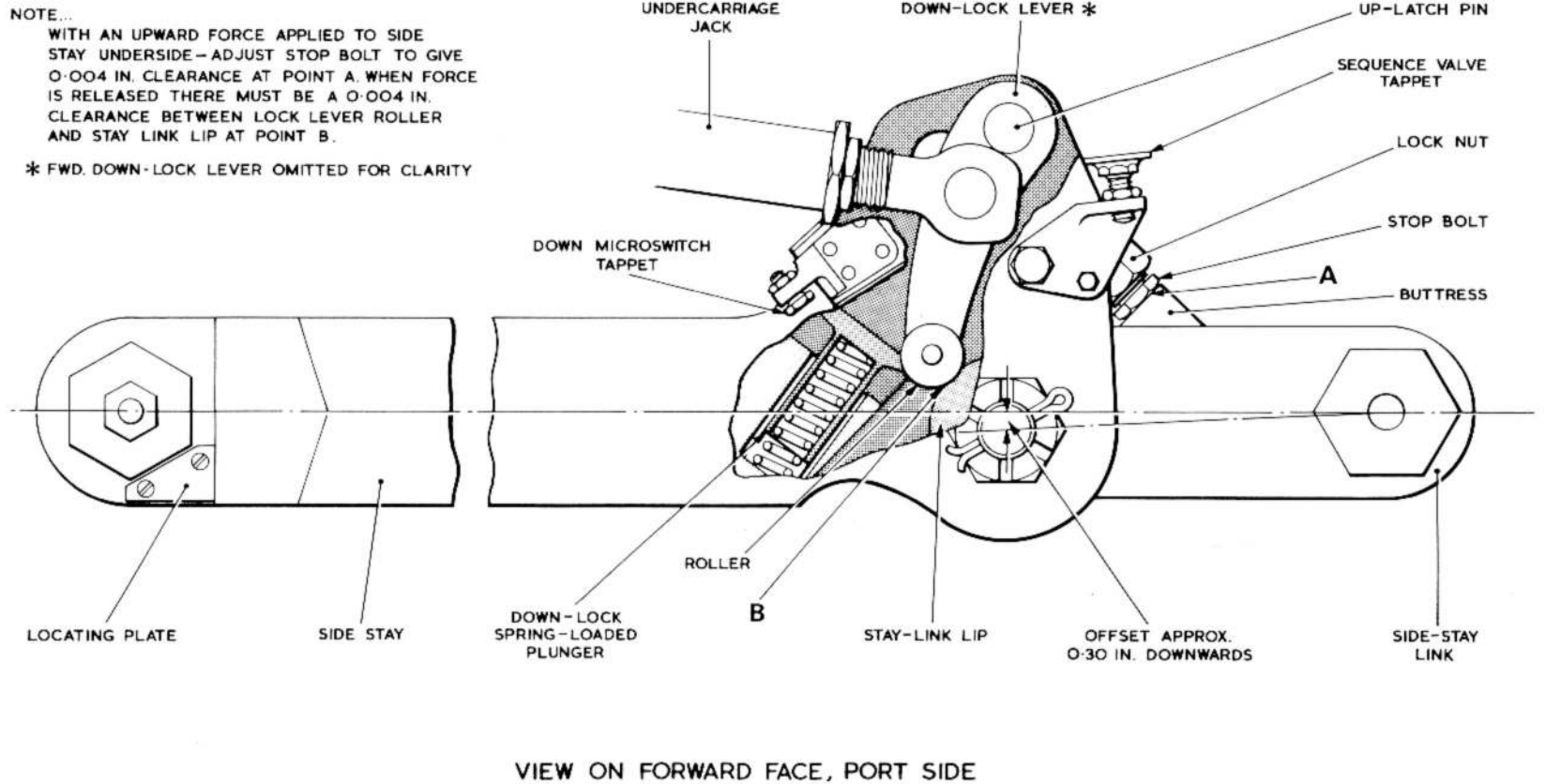


FIG. 6. SIDE-STAY AND SIDE-STAY LINK ALIGNMENT

◀ REDRAWN ▶

(2) Remove the pivot pin attaching the jack piston-rod to the down-lock lever.

(3) Check the alignment of the side stay and stay link (*para.17*), and adjust as necessary.

(4) Ensure that all hydraulic pressure is exhausted (*Chap.6*). Disconnect the hydraulic pipes and connect the jack to a hydraulic test rig.

(5) Pump the jack into the fully extended position.

(6) Loosen the locknut on the piston-rod and adjust the length of the fully extended jack until the distance between the jack pin centres exceeds the pick-up centres on the aircraft structure and side stay down-lock lever by 0.15 in. $\pm \begin{matrix} 0.00 \\ -0.05 \end{matrix}$ in.

(7) Check that the piston-rod eye-end is in safety and tighten the locknut against the spanner grip. Wire-lock the locknut and the spanner grip together.

(8) Close the jack until the jack pin centre is in alignment with the pick-up centre of the down-lock lever and fit the jack pivot pin.

(9) Remove the rig and reconnect the hydraulic pipes to the jack. Prime and bleed the jack, and function test the undercarriage (*Chap.6*).

Door jack

19. The distance between the pin centres of the door jack when fully closed must

not exceed 16.21 in. ± 0.25 in; the ram travel is 9.19 in. ± 0.06 in. The exact pin centre dimension is governed by the pick-up points on the aircraft structure and undercarriage door lock lever. The jack pin centres must be checked, and if necessary, adjusted in the following manner, following renewal, replacement, or after any servicing which may have affected its setting:-

(1) Ensure that all hydraulic pressure is exhausted from the system (*Chap.6*).

(2) Remove the pin attaching the lower end of the door jack piston-rod to the door lock lever.

(3) Check the movement of the slave link (*fig.12*) to ensure that 0.02 in. minimum to 0.03 in. maximum clearance exists between the top of the slot and the eccentric bolt shank when the door is fully down. Check the sequence valve to ensure that the plunger is depressed only to within the limits given in *para. 22*. If the necessary clearance does not exist at the top of the slave link slot it can be obtained by adjustment of the eccentric bolt; adjust the sequence-valve trip screw as detailed in *para. 22*.

Note...

There must be adequate clearance between the bottom of the slave link slot and the eccentric bolt when the door is fully up, and the link must not foul anywhere throughout its travel.

(4) Disconnect the hydraulic pipes at

the door jack and connect a hydraulic test rig to the jack.

(5) Remove the locking wire from the locknut and the splined nut at the end of the jack piston-rod and slacken the locknut.

(6) Disconnect the lower rear check link from the upper link.

(7) Close the door by hand and pull up the lock lever to move the shoot-bolts into the fully locked position.

(8) Pump the jack into the fully-retracted position, and check whether a minimum override of 0.125 in. exists by positioning the eye-end of the piston-rod between the forks of the lock lever and noting the alignment of the attachment pin hole in both components. If the override is less than the minimum required, increase it by turning the eye-end of the piston-rod one half-turn at a time until the necessary dimension is obtained.

(9) Open the door, tighten the locknut on the jack piston-rod, and wire-lock in position.

(10) Connect the lower rear check link to the upper link.

(11) Pump the jack into the fully extended position and, with the door held open but not sprung, check the alignment of the attachment-pin hole through the lock lever and piston-rod eye-end; there should be a maximum override of

RESTRICTED

0.02 in. If the override is greater or appreciably less, adjust it by varying the amount of shimming between the two parts of the lock lever; the packing is made up of 0.003 in. laminations (fig. 12).

Note...

1. Ensure that the correct A59 series close tolerance bolt is fitted to the locking lever assembly to suit the shim thickness with the appropriate plain and spring washers, (refer to Table 1). The bolt tail penetration, beyond the lock lever, when fully tightened must not be less than 0.02 in.

2. Ensure that the lock-lever counter-sunk screw has been locked by centre popping.

(12) Retract the jack slightly and align the attachment pin holes in the lock lever and the end of the piston-rod by moving the door. Insert the attachment pin and fully extend the jack.

(13) With the door fully open, check again that the maximum override (operation (11)) is present by applying hand pressure to the lower inside edge of the door; it should be possible to ro-

tate the pin securing the piston-rod to the lock lever.

(14) Disconnect the test rig, and reconnect the pipes to the jack. Prime and bleed the jack, and test the functioning of the undercarriage and door (Chap.6).

Door shoot-bolt setting (fig.7)

20. The operation and setting of the door shoot-bolts must be checked after servicing. Should adjustment be necessary: -

(1) Disconnect the door jack by removing the pin attaching the lower end of

TABLE 1

Bolt, shim and washer details for door locking lever

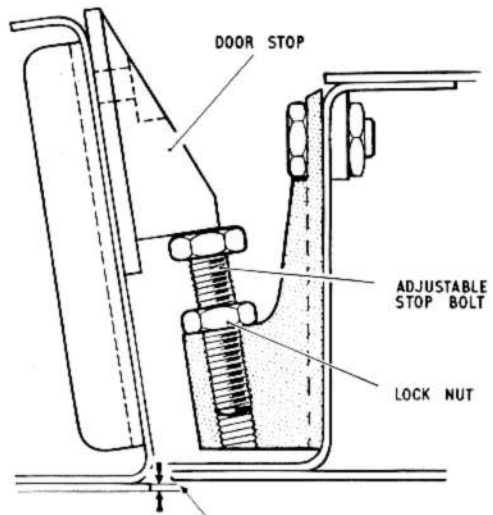
Shim thickness (in.)	Bolt Pt. No.	No. of plain washers
0.000-0.050	A59-10G	3
0.051-0.098	A59-10G	2
0.099-0.146	A59-10G	1
0.147-0.202	A59-10G	0
0.203-0.250	A59-12G	3
0.251-0.298	A59-12G	2
0.299-0.350	A59-12G	1

Note...

1. Also fit, in each case, one spring washer Ref.No.28W/9416645.

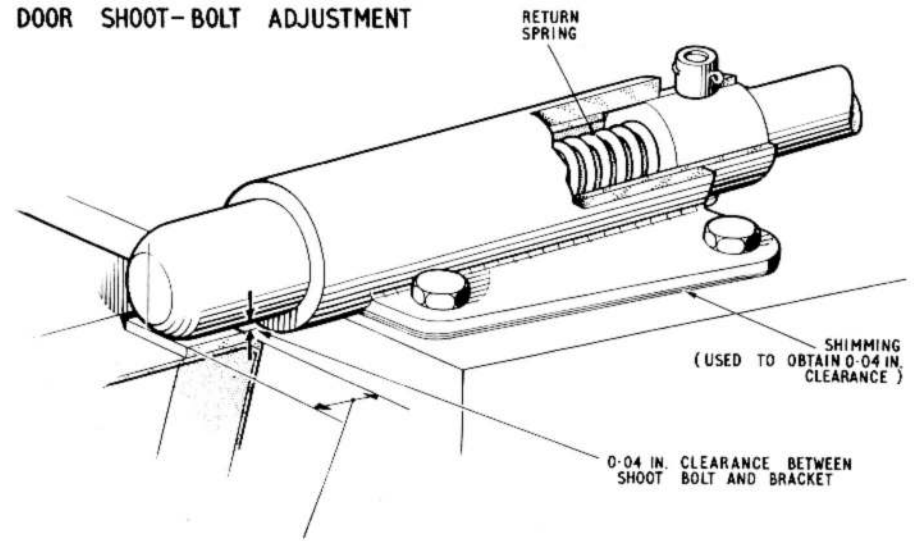
2. Bolt A59-10G is Ref.No.28D/1213610, bolt, A59-12G is Ref.No.28D/1213611 and the plain washers are Ref.No.28W/9419403.

DOOR STOP-BOLT ADJUSTMENT



ADJUST TO OBTAIN AN 0.080 IN. CLEARANCE BETWEEN LEADING EDGE OF DOOR AND MAIN PLANE UNDERSURFACE.

DOOR SHOOT-BOLT ADJUSTMENT



THIS DIMENSION TO BE AT LEAST 0.50 IN. WHEN DOOR IS UP AND SHOOT BOLTS ARE IN LOCKED POSITION.

Fig. 7. Door adjustment points

the door jack piston-rod to the lock lever.

Note...

Before any adjustments are made, the door hinges must be checked for excessive wear (A.P.101B-0400-6, Part 1, Chap.3).

(2)

(a) Disconnect the rear shoot-bolt tie-rod and adjust to its minimum length; reconnect the tie-rod, leaving the locknut slack.

(b) Manually close the door, disconnect the tie-rod between the lock lever and the bell-crank lever at the bell-crank lever end, slacken the tie-rod locknut and adjust by turning the fork-end one half-turn at a time, and connecting the tie-rod to the bell-crank lever between adjustments, until the front shoot-bolt has a minimum engagement of 0.50 in. (fig.7) when locked. Repeat this adjustment for the rear shoot-bolt by adjusting the tie-rod between the rear shoot-bolt and bell-crank lever, with the door unlocked there should be a clearance of 0.11 in. between the end of the shoot-bolts and the pads with which they engage.

Note...

The dimension 0.11 in. is for the linkage in an 'as new' condition. A relaxation of this dimension to 0.06 in. is permitted due to subsequent cumulative wear in the linkage. (Refer to A.P.101B-0400-6, Chap.3 for maximum wear limits.)

(3) When the correct adjustments have been made, tighten the locknut(s) on the tie-rod(s) and reconnect the tie-rod(s) to the bell-crank lever.

(4) Manually close the door and fully lock the shoot-bolts, checking that the two shoot-bolts contact their engagement pads either simultaneously or with the forward shoot-bolt slightly in advance of the rear shoot-bolt. Check also that the pins attaching the shoot-bolts to the tie-rods do not foul the shoot-bolt housings when the shoot-bolts are fully locked.

(5) Check that there is a 0.04 in. clearance between the flats of the shoot-bolts and their brackets (para. 21).

(6) Reconnect the door jack piston-rod to the lock lever.

(7) Manually operate the door jack sequence valve and operate the hydraulic hand pump to test the operation of the door; recheck the adjustments.

Door setting (fig.7 and 12)

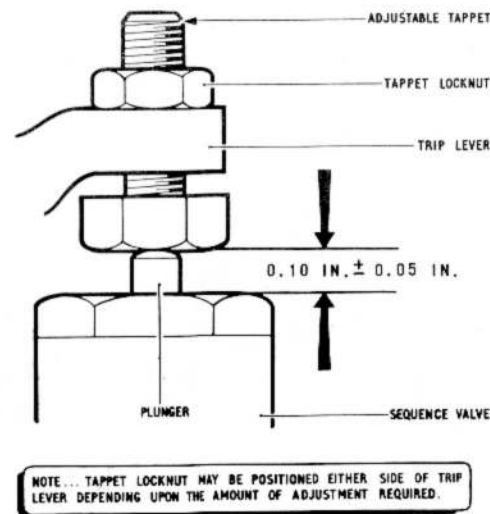
21. An adjustable stop-bolt is provided on the leading edge of the door to ensure that the door, when closed, is in its correct position relative to the wing contour. The stop-bolt is adjusted to permit the leading edge of the door to move 0.08 in. inside the wing contour; the door hinge shimming may also require adjustment to obtain this figure (para.34). With the door in its correct position the clearance between the door shoot-bolt flats and their bracket must be 0.04 in. This clearance can be obtained by adjustment of the shimming between the shoot-bolt housings and the door (fig.12).

Note...

It is not essential that the shoot-bolts and brackets are parallel across their flats; an additional 0.02 in. is permissible along one edge providing that it does not affect the clearance of 0.04 in. at the other.

Sequence-valve setting (fig.8)

22. To adjust the sequence valve tappet slacken the locknut and screw the tappet until a 0.10 in. \pm 0.05 in. clearance is obtained between the striking face of the tappet and the body of the

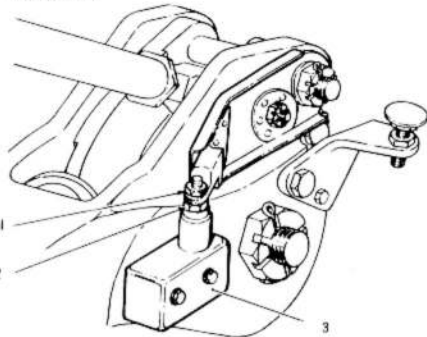


NOTE... TAPPET LOCKNUT MAY BE POSITIONED EITHER SIDE OF TRIP LEVER DEPENDING UPON THE AMOUNT OF ADJUSTMENT REQUIRED.

Fig.8. Sequence-valve adjustment

RESTRICTED

DOWN
MICROSWITCH

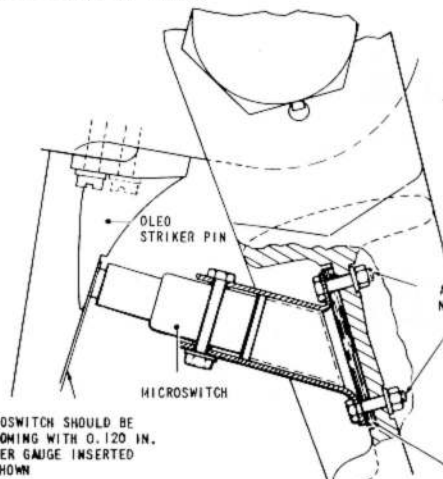


DOWN MICROSWITCH ADJUSTMENT

- 1 CONNECT A 24-VOLT POWER SUPPLY TO THE EXTERNAL SUPPLY SOCKET
- 2 SLACKEN LOCKNUT (1)
- 3 SCREW STRIKER BOLT (2) AWAY FROM MICROSWITCH (3) (GREEN LIGHT OFF)
- 4 SCREW STRIKER BOLT (2) TOWARDS MICROSWITCH (3) UNTIL A DEFINITE CLICK IS HEARD (GREEN LIGHT ON) AND THEN GIVE A FURTHER TWO COMPLETE TURNS
- 5 TIGHTEN LOCKNUT (1) AND ENSURE THAT SOME PLUNGER MOVEMENT REMAINS

STARBOARD OLEO LEG MICROSWITCH
ADJUSTMENT

- 1 JACK AND TRESTLE THE AIRCRAFT WITH THE WHEELS CLEAR OF THE GROUND (SECT. 2, CHAP. 4)
- 2 INSERT A 0.120 IN. FEELER GAUGE BETWEEN THE MICROSWITCH PLUNGER AND THE OLEO STRIKER PIN. THE PLUNGER SHOULD JUST BE BOTTOMING
- 3 IF THE ADJUSTMENT (OPERATION 2) IS INCORRECT PROCEED AS FOLLOWS:-
(a) REMOVE THE MICROSWITCH ATTACHMENT NUTS (8) AND WASHERS, AND WITHDRAW THE MICROSWITCH TOGETHER WITH LAMINATED PACKING PLATE (9)
(b) BY PEELING A NEW LAMINATED PACKING PLATE REF. NO. 26FZ/706 ADJUST THE MICROSWITCH TO OBTAIN THE CONDITION DESCRIBED IN OPERATION 2
- 4 RE-CHECK THE ADJUSTMENT AFTER HAVING FINALLY REFITTED THE MICROSWITCH AND TIGHTENED THE SECURING NUTS



MICROSWITCH SHOULD BE
BOTTOMING WITH 0.120 IN.
FEELER GAUGE INSERTED
AS SHOWN

SECTIONAL VIEW ON STARBOARD TORQUE LINK

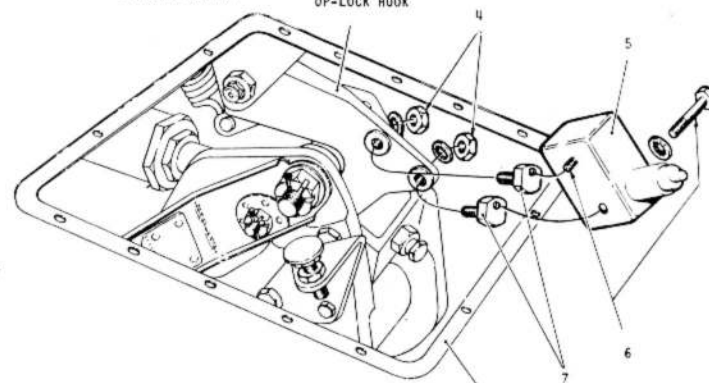
LAMINATED PACKING
PLATE

UP MICROSWITCH ADJUSTMENT
WITH U/C IN THE UP POSITION

- 1 JACK AND TRESTLE THE AIRCRAFT WITH THE WHEELS CLEAR OF THE GROUND (SECT. 2, CHAP. 4)
- 2 CONNECT A 24-VOLT POWER SUPPLY TO THE EXTERNAL SUPPLY SOCKET AND CHECK THAT THE GREEN LIGHT IS ON
- 3 REMOVE THE APPROPRIATE ACCESS PANEL FROM THE UPPER SURFACE OF THE MAIN PLANE INNER WING (SECT. 2, CHAP. 4)
- 4 SLACKEN THE NUTS (4) AND THE MICROSWITCH ATTACHMENT BOLTS (6) AND TURN THE HEADS OF THE ECCENTRIC BOLTS (7) SO THAT THE MICROSWITCH ATTACHMENT TAPPED HOLES ARE AT THE FURTHEST POINT OF ADJUSTMENT AWAY FROM THE HOOK (I.E. PARALLEL WITH THE ADJACENT BACK EDGE OF THE HOOK)
- 5 TIGHTEN THE ATTACHMENT BOLTS (6) AND NUTS (4)
- 6 USING THE AIRCRAFT HYDRAULIC HAND PUMP, FULLY RETRACT THE MAIN U/C (SECT. 3, CHAP. 6) AND APPLY FULL JACK PRESSURE. ENSURE THAT THE RED LIGHT COMES ON DURING THE OPERATION
- 7 CHECK THAT WITH THE U/C UP-LOCK FULLY ENGAGED (SECT. 3, CHAP. 5A, FIG. 1) THE RED LIGHT HAS GONE OFF
- 8 MAINTAIN FULL JACK PRESSURE AND THROUGH THE ACCESS PANEL APERTURE LIFT THE HOOK CLEAR OF THE UP LATCH PIN AND CHECK THE RED LIGHT COMES ON. RETURN THE HOOK TO THE ENGAGED POSITION AND CHECK THE RED LIGHT HAS GONE OFF
- 9 IN THIS CONDITION, CHECK THAT THE GAP BETWEEN THE MICROSWITCH BARREL AND THE SIDESTAY OPERATING FACE IS BETWEEN 0.08 IN. (14 S.W.G.) MIN. AND 0.13 IN. (10 S.W.G.) MAX. USING A FEELER PLATE OF THE APPROPRIATE THICKNESS
- 10 IF THE MAX. GAP IS IN EXCESS OF 0.13 IN., SLACKEN THE NUTS (4) AND TURN THE ECCENTRIC BOLT HEADS (7) IN SEQUENCE (COUNTER-CLOCKWISE, PORT U/C; CLOCKWISE, STARBOARD U/C) TO DEPRESS THE MICROSWITCH PLUNGER FURTHER INTO THE OVERTRAVEL WITHIN THE LIMITS OF OP. 9
- 11 EXHAUST THE JACK PRESSURE AND SELECT U/C DOWN (SECT. 3, CHAP. 6). USING THE AIRCRAFT HYDRAULIC PUMP, PUMP SLOWLY UNTIL THE D-DOOR UNLOCKS. PULL THE D-DOOR OPEN BY HAND TO THE FUSELAGE SIDE, OPERATING THE U/C DOWN SEQUENCE VALVE. CHECK THAT THE RED LIGHT DOES NOT COME ON
- 12 IF DURING OP. 11 THE RED LIGHT COMES ON, REPEAT PROCEDURE DETAILED IN OP. 10
- 13 SELECT U/C UP AND RETURN THE U/C TO THE FULLY RETRACTED POSITION
- 14 RECHECK THE PLUNGER GAP TO OP. 9

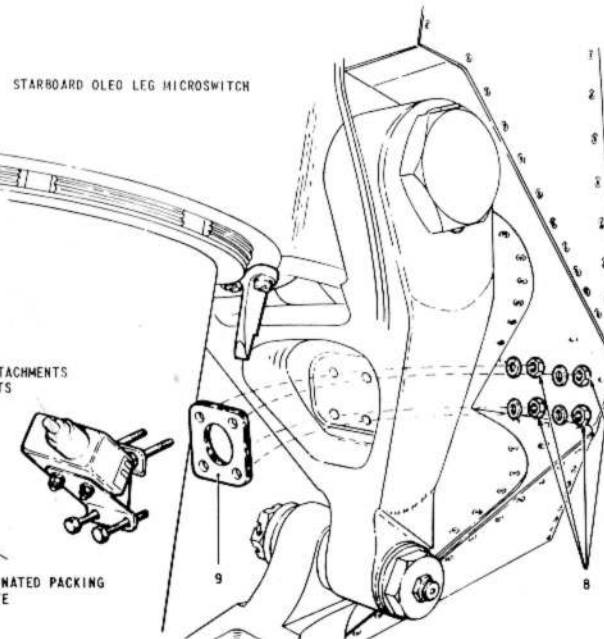
UP MICROSWITCH

UP-LOCK HOOK



ACCESS IN UPPER
SURFACE OF INNER
WING

NOTE...
AFTER AN ADJUSTMENT OF THE
UP OR DOWN MICROSWITCHES AN
UNDERCARRIAGE RETRACTION TEST
MUST BE MADE AND THE WARNING
LIGHTS CHECKED



STARBOARD OLEO LEG MICROSWITCH

ATTACHMENTS
NUTS

FIG. 9. MICROSWITCH ADJUSTMENT - MAIN UNDERCARRIAGE

◀ DETAIL AND TEXT AMENDED ▶

RESTRICTED

sequence valve when the valve plunger is depressed (*fig.8*). After adjustment, check the operation of the sequence valve (*Chap.6*) and tighten the locknut.

Up-latch hook setting (*fig.1*)

23. The up-latch hook is set by the manufacturers and should not normally require alteration, the clearance between the hook and up-latch pin being obtainable by adjustment of the up-stop block (*para.24*). If, after renewal of the hook or undercarriage unit, it is found necessary to adjust the hook bracket, the shimming between the bracket and up-lock beam may be varied accordingly, care being taken to ensure that the attitude of the hook is not altered when doing so. To adjust the hook bracket:-

(1) Disconnect the return spring from the up-latch hook and remove the hook from the bracket, ensuring no damage is done to the microswitch or its connections.

(2) Remove and discard the attachment bolts and remove the bracket from the up-lock beam.

(3) Adjust the shimming as necessary and ensure that it will not affect the original attitude of the hook.

(4) Refit the bracket to the up-lock beam using new bolts. When the hook is correctly set (*para.24*),peen over the bolts to lock.

(5) Refit the up-latch hook and connect the return spring.

Note...

When a new hook is fitted the 'up' microswitch must be adjusted (fig.9).

Up-stop block setting (*fig.1*)

24. A rubber or Tufnol block in the roof of the wheel well receives the impact made by the wheel axle towing eye when the undercarriage is retracted. This block is adjusted to obtain the correct clearance between the up-latch hook and up-latch pin (*para.23*) by varying the shims between the block and bracket. When the undercarriage is fully raised adjust the shims beneath the block to give a clearance of 0.01 in. to 0.015 in. between the up-latch hook and up-latch pin (*fig.1*) access to the hook when the undercarriage is raised is gained through a panel in the main-plane upper surface (*Sect.2, Chap.4*).

Torque-link tolerance and adjustment

25. The centre pivot pin of the torque links should be examined for wear during servicing operations on the undercarriage. The correct clearance at this point is 0.001 in. to 0.004 in., but a maximum clearance of 0.001 in. to 0.010 in. is allowed due to cumulative wear (*Sect.2, Chap.6, App.1*). If the clearance exceeds 0.010 in., it must be rectified by adding a new washer Ref.No.26 FZ/715 to bring about the original tolerance of 0.001 in. to 0.004 in.

Microswitch settings

26. After any servicing or component replacement which may have affected the microswitch settings, a thorough check, and if necessary resetting, must be made as detailed in *fig.9*.

Leg-fairing alignment

27. The undercarriage leg spat-type fairing is adjusted to the main-plane contours by varying the shims fitted between the fairing and the four attachment bosses on the strut. When all the undercarriage adjustments are correct, the undercarriage raised and resting in the up-latch hook, adjust the shims until the leading-edge of the fairing is 0.05 in. inside the main-plane contour and the trailing edge is flush. When a new fairing is fitted file off the trim allowance to give 0.05 in. to 0.08 in. clearance around the spat perimeter.

Note...

Protective treatment (A.P.119A-0509-1) must be applied to all filed surfaces.

New engine cowl flap fitting and adjustment

28. The flap is adjusted by means of the operating rod which connects it to the top of the shock-absorber strut. Adjustment is made until the flap is flush with the engine cowl skin when the undercarriage is fully retracted. When fitting a new flap the following procedure must be adopted:-

(1) Attach the flap to the engine cowl and connect the operating rod and check cable.

(2) Remove the rubber or Tufnol blocks.

(3) With the engine lower rear cowl fitted and the undercarriage retracted, file the trim allowance of the flap to

ensure a butt fit on the cowl skin with the flap 'out-of-wind'.

◀ **Note . . .**

Protective treatment (A.P.119A-0509-1) must be applied to all filed surfaces. ▶

(4) Remove the engine top-cowl, connect the operating rod to the shock-absorber strut bracket, and adjust the operating rod until the flap is closed.

(5) Fully slacken the check cable tension rod.

(6) Lower the undercarriage.

(7) Partially retract the undercarriage and fit the rubber or Tufnol blocks.

Note...

Tufnol blocks are to be filed and trimmed to suit. Rubber blocks are to be reduced if too large and packed by light-alloy strip if too small.

(8) With the flap in the open position, adjust the check cable tension rod until it is finger-tight and then slacken back one turn. Lock the tension rod.

(9) Tighten the nut and peen over the bolt attaching the check cable to the flap arm.

REMOVAL AND ASSEMBLY

General information

29. The following paragraphs detail the removal and assembly operations for the undercarriage and its main components.

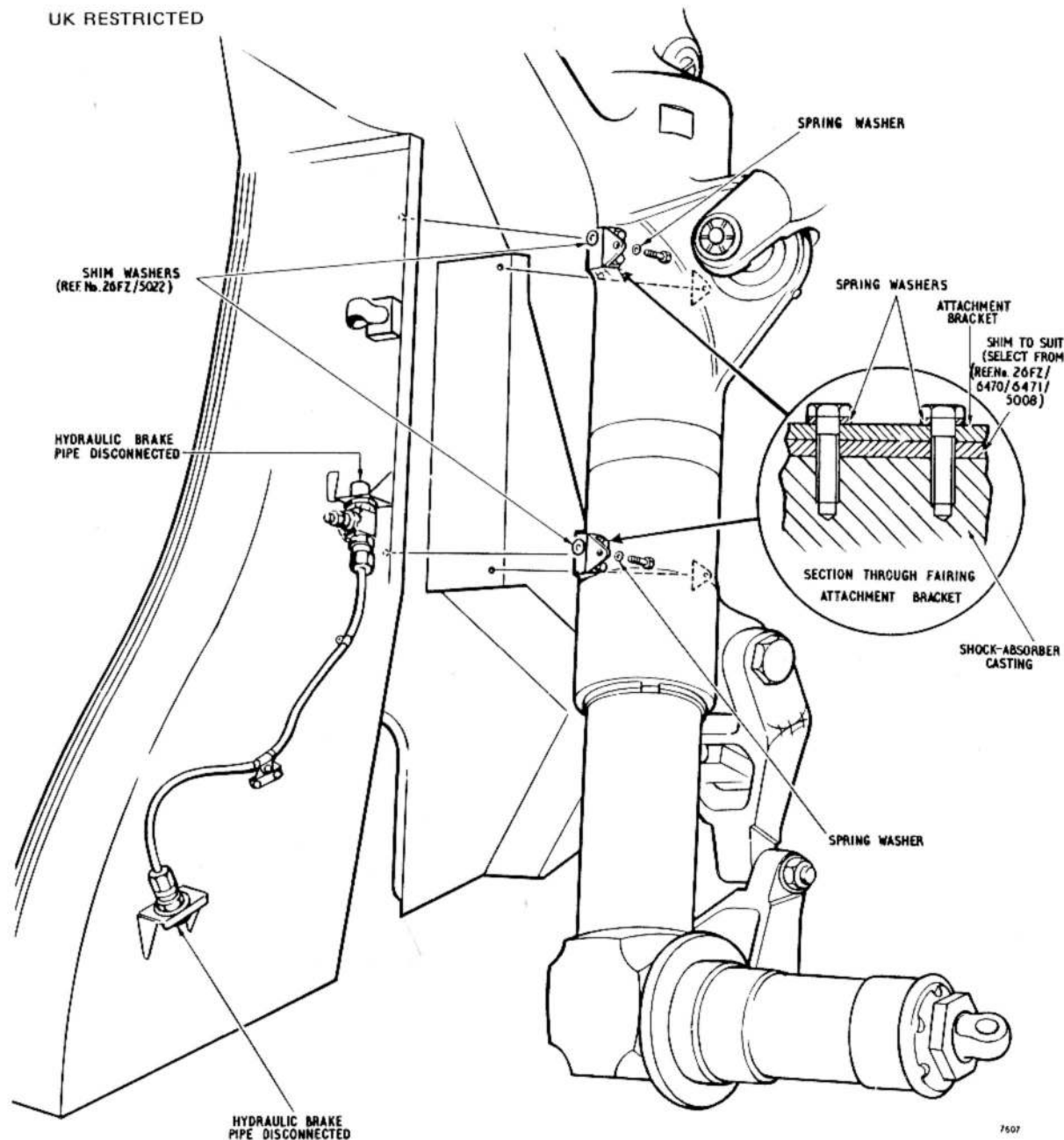


Fig. 10. Leg-fairing removal and assembly

Items which do not require special instructions for removal or assembly are not included. The sequence of operations for assembling the undercarriage and door must be adhered to. Checks and subsequent adjustments referred to are to be made at the stated operation.

Undercarriage (fig.11)

Removal

30. To remove the undercarriage and its main components:-

(1) Jack and trestle the aircraft (Sect.2, Chap.4).

(2) Exhaust all hydraulic pressure from both the main and brake hydraulic systems (Chap.6).

(3) Remove the wheel and if necessary the brake unit (fig.13) from the wheel axle. Blank off exposed hydraulic pipes and apertures.

Note...

Unless the brake unit is life expired or damaged, it need be removed only if a replacement strut is to be fitted. Care must be taken when handling a shock-absorber strut when the brake unit has not been removed.

(4) Remove the bolt from the oleo leg end of the flap door connecting rod (detail B).

(5) Remove the bottom rear engine cowl (Sect.4, Chap.1).

(6) Disconnect the wheel brake flexible hydraulic pipe from its connection

at the bleed valve bracket on the spat fairing (fig.10). Blank off exposed pipe ends.

(7) Unclip the flexible hydraulic pipe from the top of the fairing.

(8) Disconnect the flexible hydraulic pipe from the bracket at the bottom of the fairing. Blank off exposed pipe ends.

(9) Disconnect the electrical cables from the microswitch on the upper torque link, and unclip and release the cable from the fairing (starboard undercarriage only).

(10) Remove the four fairing attachment bolts from the brackets of the shock-absorber strut, remove the fairing and retain the shimming (fig.10).

Note...

If the fairing or strut is to be replaced the four brackets must be removed from the bosses on the strut. Retain the shimming.

(11) Disconnect both flexible hydraulic pipes from the main jack (detail C). Blank off exposed pipes and apertures.

(12) Remove the split pin and nut from the jack piston rod attachment bolt (detail A), and remove the bolt.

(13) Remove the split pin and nut from the jack pivot pin (detail C), and remove the jack from the aircraft.

(14) Disconnect the electrical cables

from the down lock microswitch (detail A).

(15) Unclip the hydraulic pipe and electrical cables from the side stay. Coil and stow the electrical cables.

(16) Disconnect the flexible hydraulic brake pipe from the bracket at rib B on the main spar bulkhead, and remove the pipe from the aircraft. Blank off exposed pipe ends.

(17) Remove the split pin and nut from the stay-link bolt at the spherical joint on the shock-absorber strut casting, and withdraw the bolt (detail A).

(18) Support the side stay and link and remove the locating plate from the side stay spherical pivot bolt (detail D).

(19) Withdraw the side-stay pivot bolt and remove the side stay and link from the aircraft.

(20) Remove the split pin from the slotted nut on the shock-absorber strut main pivot bolt and, using spanner Ref.No.26FZ/95060, remove the nut. With the nut removed, withdraw the locking plate (detail B).

(21) Support the strut and, using spanner Ref.No.26FZ/95059, withdraw the strut pivot bolt (detail B). Remove the shock-absorber strut from the aircraft.

Note...

1. *Should difficulty be encountered when removing the main pivot bolt, it may be found advantageous to screw*

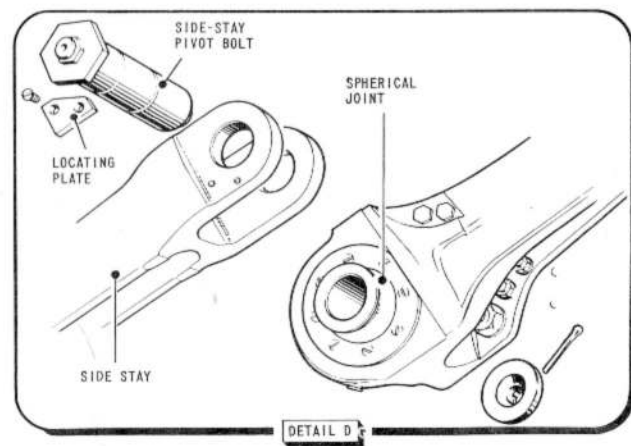
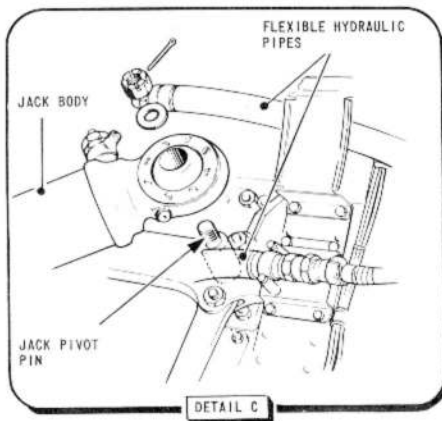
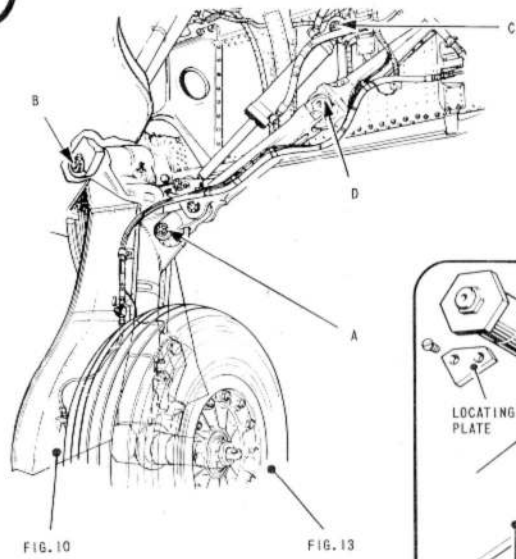
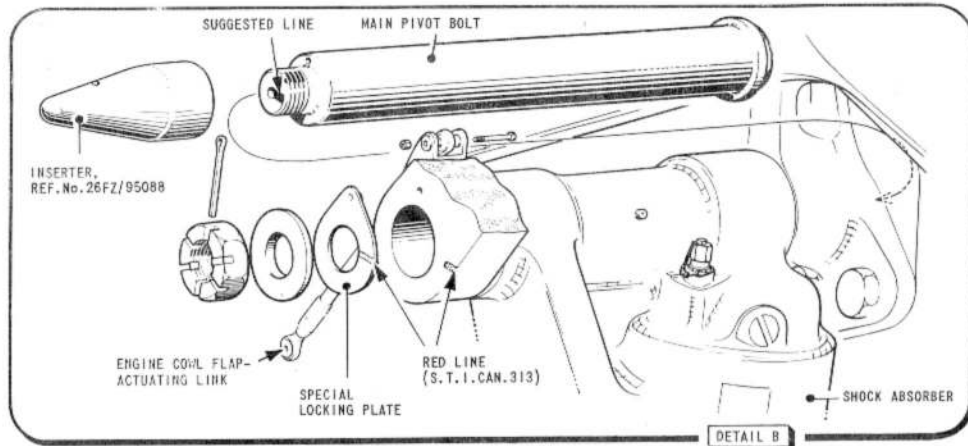
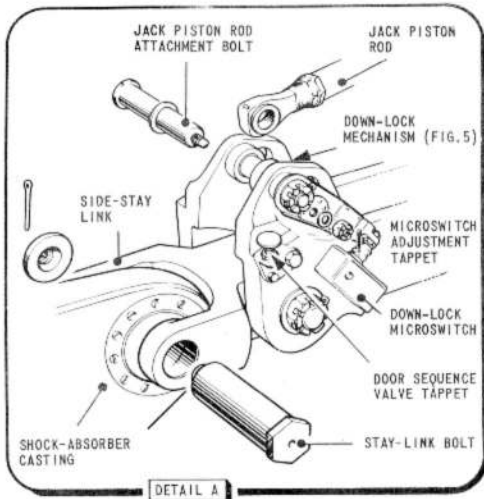


FIG. 11. UNDERCARRIAGE REMOVAL AND ASSEMBLY

inserter Ref.No.26FZ/95088 (detail B) on to the thread of the pivot bolt and give the end of the inserter a sharp knock with a hide-faced mallet.

2. Access to the head of the main pivot bolt can be gained through a panel in the main-plane undersurface (Sect.2, Chap.4).

3. Care must be taken when handling a shock-absorber strut when the brake unit has not been removed.

Assembly (fig.11)

31. To assemble the undercarriage and its main components:-

(1) With inserter Ref.No.26FZ/95088 (detail B) screwed on to the threads of the main pivot pin, assemble the shock-absorber strut, less wheel and spat-type fairing, to the main-plane pick-up point.

(2) Remove the inserter and fit the pivot bolt locking plate, slotted nut and split pin to secure the pivot bolt.

Note...

On refitment of the main pivot bolt locking plate, check that the red line (S.T.I.CAN.313) is still visible, and that the locking plate dowel holes are aligned. If necessary, rotate the pivot bolt to enable the plate to be pushed home by hand; the dowels must not be forced home by tightening the nut. A red line painted on the end of the main pivot bolt in the same relative position as the line introduced by S.T.I.CAN 313 will enable a check

to be made, before tightening the nut, to ensure that the pivot bolt and locking plate are in line.

(3) Fit a dummy sleeve and weight Part No.EA1.88.371 to the wheel axle to make up the width of the wheel hub against which the towing eye abuts.

Note...

The towing eye forms the undercarriage up-stop.

(4) Assemble the side stay and link in the reverse order of removal (para.30), fitting split-pins to lock the slotted nuts of both pivot bolts. Secure the locating plate at the side-stay pivot bolt head and wire-lock the pivot bolt grease nipple stud to the locating plate (detail D).

(5) Fit the undercarriage jack at its main spar pivot attachment and lock the slotted nut with a split pin.

(6) Connect a hydraulic test rig Ref. No.4F/1685 to the jack and ensure that the jack is fully extended. Adjust its length by screwing the piston-rod eye-end either in or out to obtain the correct override past the jack pick-up point centres on the stay-link lock lever bolt (para.18). Wire-lock the piston-rod locknut.

(7) Close the jack until the pick-up centres coincide, and secure the piston-rod end to the down lock lever bolt. Lock the slotted nut with a split pin.

(8) Uncouple the up-latch hook return spring.

(9) With the hydraulic test rig connected to the main jack, raise the undercarriage (2750 lb/in²) and, whilst under jack load, check the clearance between the up-latch hook and the up-latch pin (fig.1). If adjustment is required, vary the shim thickness beneath the up-stop block in the wheel-well roof (para.24).

Note...

1. It may be necessary to adjust the up-latch hook (para.23); ensure that the hook attitude is not altered.

2. Access to the up-latch hook, when the undercarriage is retracted, is gained through a panel in the upper surface of the inner main plane (Sect.2, Chap.4).

(10) Lower the undercarriage and reconnect the up-latch hook return spring.

(11) Release the locknut of the sequence valve tappet on the side-stay knuckle joint, and screw the tappet as far as possible into the casting.

(12) Raise the undercarriage and adjust the tappet so that the sequence valve plunger is depressed to the dimensions given in fig.8. Tighten the locknut.

Note...

Access to the sequence-valve tappet when the undercarriage is raised is gained through the same panel as for

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the up-latch hook (operation (9), Note (2)).

(13) Check the up microswitch setting and adjust if necessary (fig.9).

(14) Partly raise the undercarriage and attach the spat-type fairing to the shock-absorber strut in the reverse order of its removal (para.30).

(15) With the undercarriage resting in the up-latch hook, check the skin contour dimensions around the fairing perimeter; they must be as given in para.27. If adjustment is required, vary the shims beneath the fairing attachment brackets on the four bosses of the shock-absorber strut (fig. 10).

(16) Lower the undercarriage, remove the dummy sleeve from the wheel axle and fit the wheel (fig. 13).

(17) Reconnect and clip the brake hydraulic pipes to the side-stay and leg fairing, leaving the clips partly tightened. Wire-lock the unions.

(18) Reconnect and clip the microswitch cables to the side stay and hydraulic pipes as shown in figs. 11A and 11B. Leave the clips partly tightened.

(19) Check the settings of the down-lock micro-switch and, on the starboard undercarriage, the oleo leg switch; if necessary, adjust (fig.9).

(20) Fit the rear half of the engine lower cowling, connect the flap-operating link and, if necessary, adjust to give the flap a flush fit with the cowl (para.28) when the undercarriage is raised.

(21) Using the hydraulic test rig, raise and lower

the undercarriage to check no setting has been disturbed.

◀(22) Disconnect the test rig and connect the hydraulic pipes to the undercarriage jack as shown in Fig.11C. Wirelock the unions. ▶

Note...

Upon completion of the wiring and piping installation and before final tightening of the securing clips:-

1. Using the hand pump, fully retract and lower the undercarriage (Sect.3, Chap.6).

2. Check that, all points of travel (and with the undercarriage locked up and down), all pipes and cables are safely routed, do not chafe and are not trapped or stretched. (figs. 11A and 11B).

(23) Tighten all securing clips.

(24) Prime and bleed the jack and brakes.

(25) Test the functioning of the undercarriage and brakes (Chap.6).

(26) Ensure that all bolts, nuts, pins, and unions are correctly locked.

Note...

If after fitting a replacement shock absorber strut, slight oil leakage occurs from the gland area, further flights may be made to allow the seals to bed-in before rejecting the strut as unserviceable.

Fitting a replacement undercarriage unit

32. The following operations, additional to para. 31, are recommended whenever a main undercarriage

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unit is changed.

(1) Fit the up-stop cradle and pad (fig.1) together with the special shim packing, Ref.No. 26FZ/9184.

(2) Fit undercarriage up-latch bracket, with hook attached and spring connected, and the special shim, Ref.No. 26FZ/18513, interposed between structure and bracket.

(3) Wrap a 0.010 - 0.015 in. lamination around the up-latch pin on the side-stay assembly and raise the undercarriage by hand pump or hydraulic rig applying full hydraulic pressure.

(4) Check that the up-latch hook is moved only by the up-latch pin. To ensure correct alignment between up-latch hook and up-latch pin, adjustment may be made by tapering the shim.

Note...

1. If the towing eye on the undercarriage main wheel hits the stop pad and the door-jack sequence valve is operated before the up-latch hook engages correctly, further shimming, Ref. No. 26FZ/5055, may be added to the up-latch hook bracket with a corresponding reduction of shimming under the stop pad.

2. Any additional laminations required at either position must be halved and the equivalent amount removed from the other, e.g. if 0.050 in. is required under the up-latch hook bracket fit 0.025 in. and remove 0.025 in. from under the stop pad. Additional shims to the basic 10 s.w.g. L.72 packing under the stop pad may be made by adding laminations from laminated aluminium shim, Ref.No. 26FZ/6166.

(5) Check, after adjusting shims, that the initial movement of the up-latch hook is made by contact with the up-latch pin and not the lever on the side stay and that a gap of 0.010 in. to 0.015 in. between the up-latch pin and the up-latch hook (fig.1) is present on full retraction.

(6) Fit and adjust the microswitch (fig.9).

(7) Repeat the undercarriage retraction and check alignment and relevant settings.

(8) Finally, check that on retraction the undercarriage fixed fairing is correctly aligned (para. 28) by adjustment of the shim packings fitted between the shock-absorber strut and the fixed fairing.

Undercarriage door (fig.12)

Removal

33. To remove an undercarriage door:-

(1) Fully open the door.

(2) Remove the pin connecting the door jack piston rod to the lock lever between the lugs of the front door hinge.

(3) Remove the bolt about which the lock lever, side links and lower check-links pivot.

(4) Remove the hinge bolt from the front and rear door hinges, and remove the door.

Assembly

34. To assemble the undercarriage door:-

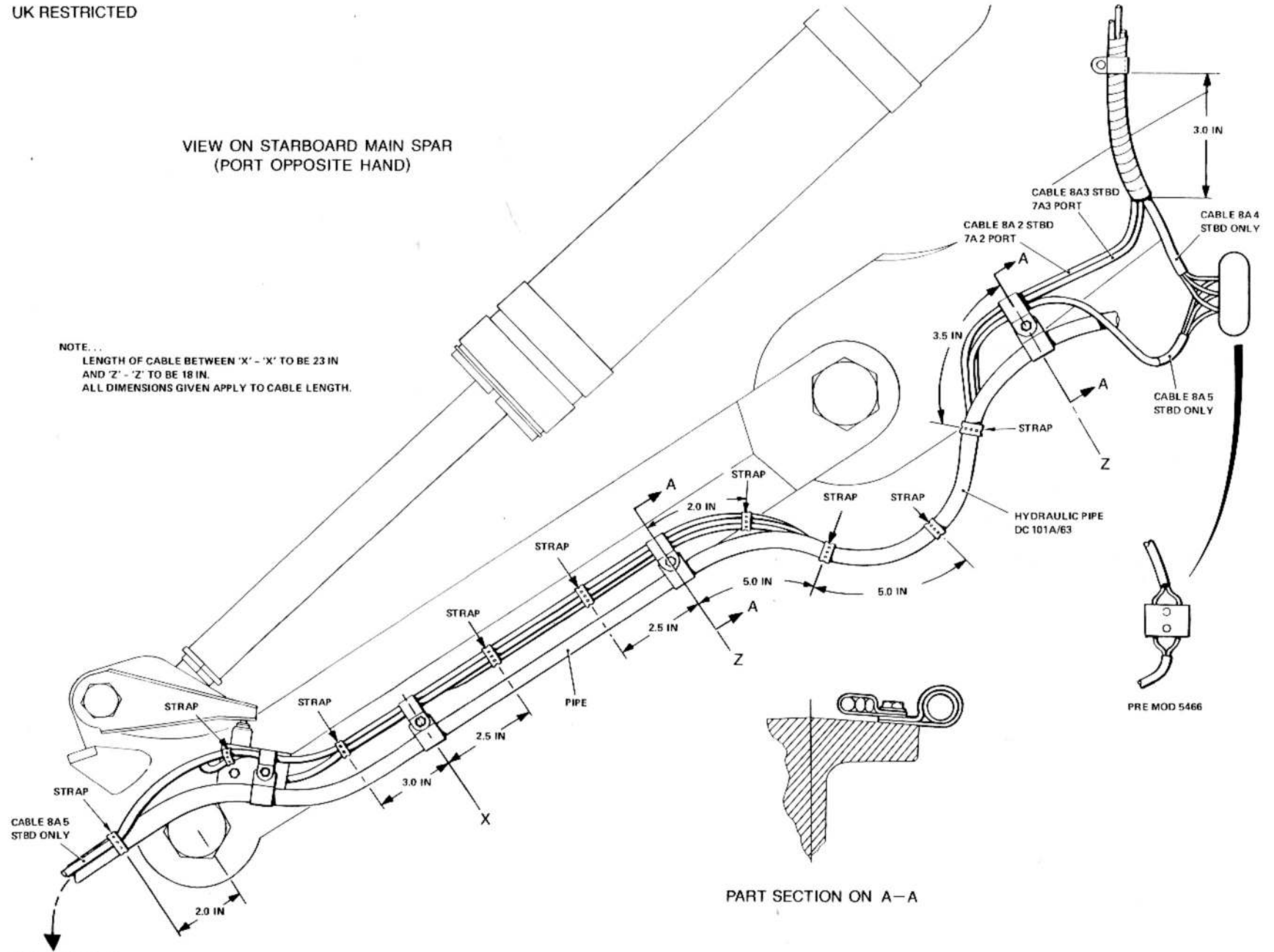
Note...

Refer to A.P.101B-0400-6, Part 1, Chap.3, for

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VIEW ON STARBOARD MAIN SPAR
(PORT OPPOSITE HAND)

NOTE...
LENGTH OF CABLE BETWEEN 'X' - 'X' TO BE 23 IN
AND 'Z' - 'Z' TO BE 18 IN.
ALL DIMENSIONS GIVEN APPLY TO CABLE LENGTH.



FOR CONTINUATION
SEE FIG.11A

PART SECTION ON A-A

FIG. 11B UNDERCARRIAGE - PIPING AND WIRING INSTALLATION

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fitment of a new undercarriage door. Reference should also be made to the instructions given in STI/CAN/392 and STI/CAN/497.

(1) Jack and trestle the aircraft (Sect.2, Chap.4).

(2) Attach the door to its hinges and fit the slave link mechanism (para.35).

Note...

The front hinge bolt acts as a pivot for the side links at their inboard end.

(3) Close the door manually and ensure that a 0.08 in. maximum skin gap exists at the door leading-edge. File the leading edge if necessary.

Note...

◀ Protective treatment (A.P.119A-0509-1) must be applied ▶ to all filed surfaces.

(4) Adjust the door stop-bolt (para.21) until the door leading edge is 0.08 in. inside the wing contour out-of-wind. If necessary adjust the shimming between the door forward hinge bracket and door (para.36).

(5) The trailing edge of the door must be flush with the skin contour. If necessary, adjust the shimming between the door rear hinge bracket and door (para.36).

(6) Fit the bolt about which the lock lever, side links and lower check links pivot.

(7) Ensure that the pressure is exhausted from the hydraulic system (Chap.6). Disconnect the flexible pipes from the door jack and connect a hydraulic test rig to the jack.

(8) Check, and if necessary, adjust the door jack overrides (para.19).

Note...

1. Ensure that the correct A59 series close tolerance bolt is fitted to the locking lever assembly to suit the shim thickness with the appropriate plain and spring washers (refer to Table 1). Torque load to 115-125 lbf in. The bolt tail penetration, beyond the lock lever, when fully tightened must not be less than 0.02 in.

2. Ensure that the lock-lever countersunk locating screw has been locked by centre-popping.

(9) Check the operation of the door shoot-bolts and adjust if necessary (para.20).

(10) Check the sequence valve tappet

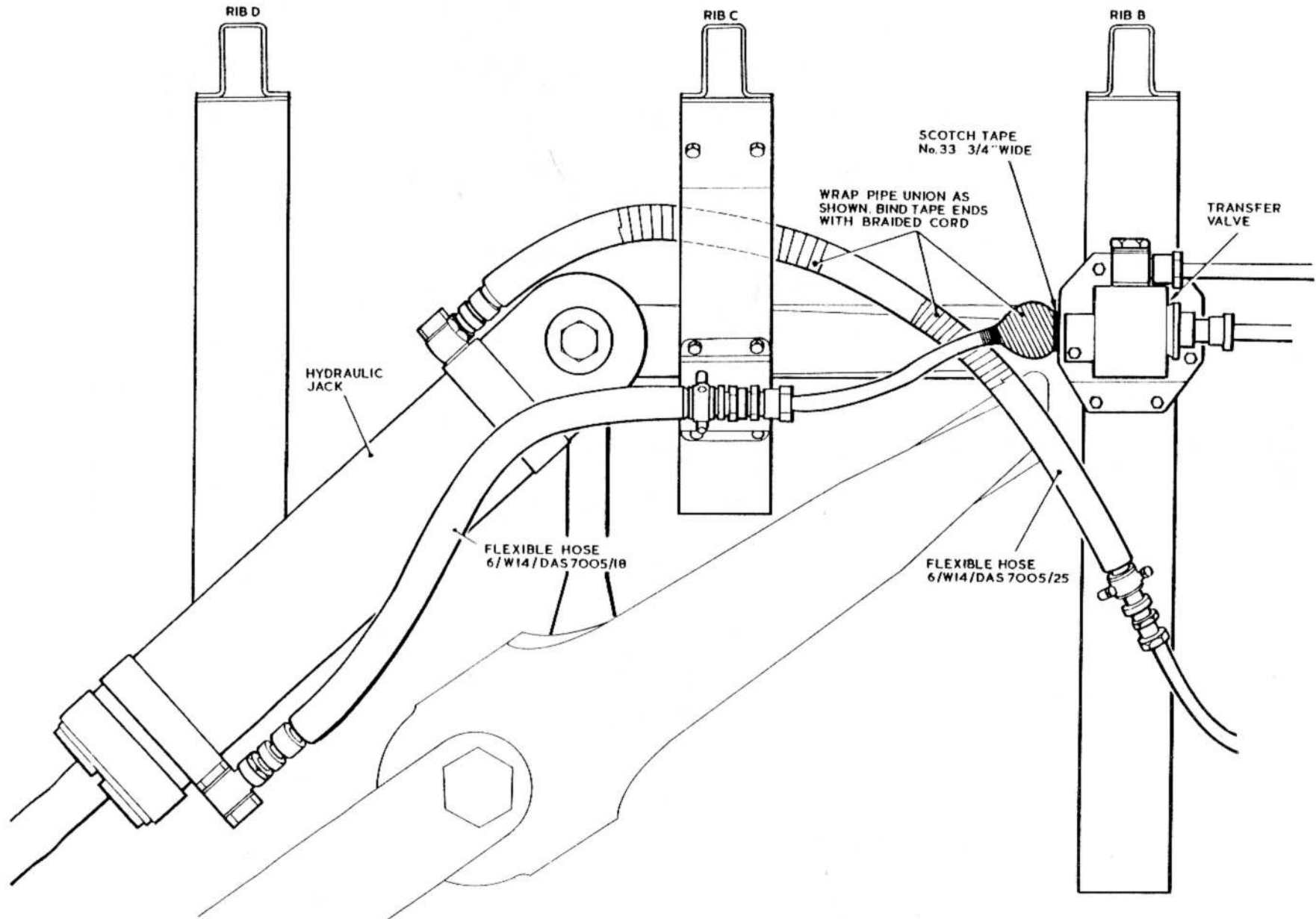
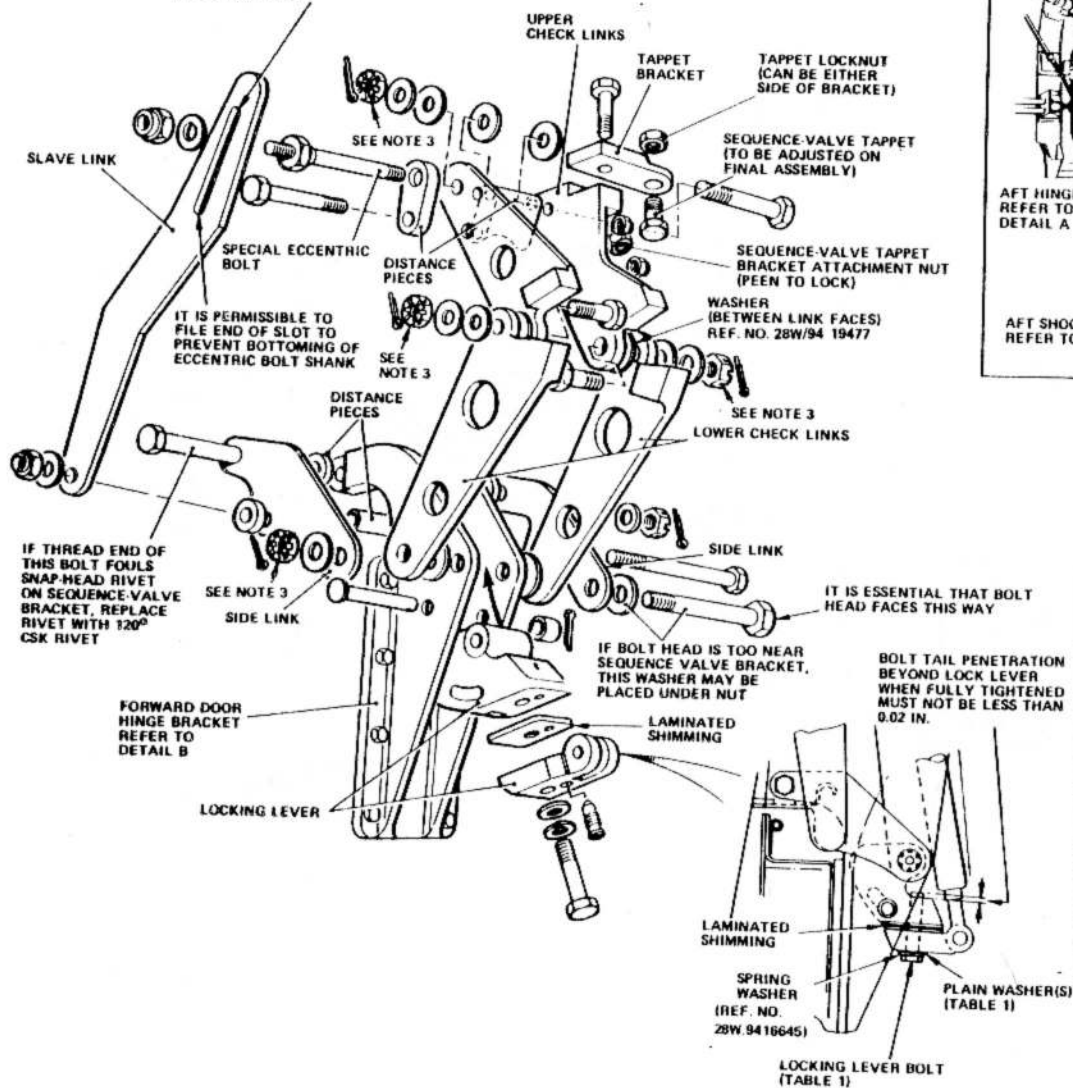


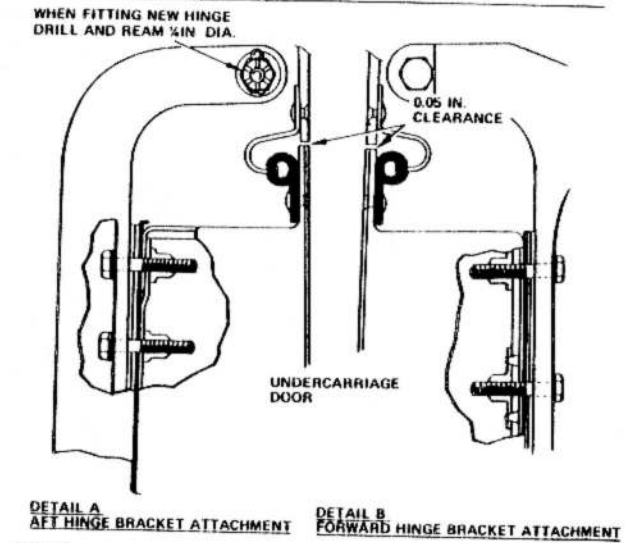
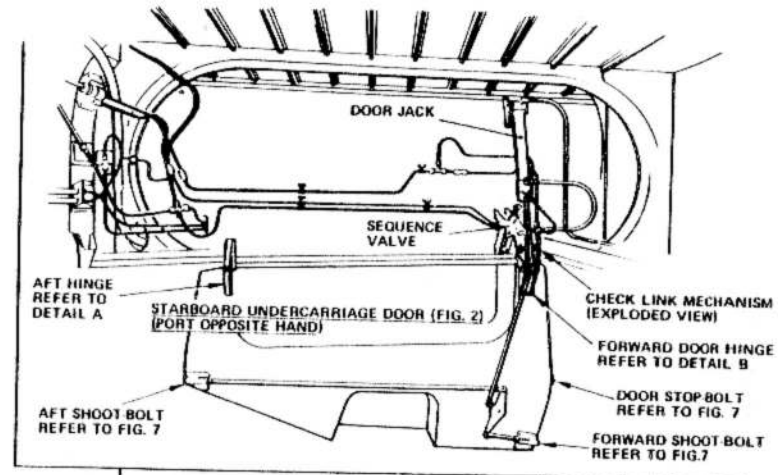
FIG. IIC. UNDERCARRIAGE - HOSE INSTALLATION

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IT IS PERMISSIBLE TO FILE END OF SLOT TO OBTAIN 0.02 IN. TO 0.03 IN. CLEARANCE FROM ECCENTRIC BOLT SHANK WHEN CHECK LINKS ARE CONNECTED



CHECK-LINK MECHANISM ASSEMBLY



DETAIL A AFT HINGE BRACKET ATTACHMENT
DETAIL B FORWARD HINGE BRACKET ATTACHMENT

- NOTES ...
1. FOR DOOR/HINGE BOLT SIZES AND WASHER REQUIREMENTS REFER TO A.P. 101B-0400-6, PART 1, CHAP. 3.
 2. WHENEVER THE FORWARD DOOR HINGES ARE ADJUSTED A MINIMUM CLEARANCE OF 0.010 IN. MUST EXIST WHEN THE DOORS ARE CLOSED BETWEEN THE FORWARD HINGE BRACKETS AND THE FUSELAGE SIDE OR ATTACHED STRUCTURES ALSO BETWEEN THE SIDE LINKS AND THE FUSELAGE SIDE OR ATTACHED STRUCTURES, WITH THE DOORS OPEN A MINIMUM CLEARANCE OF 0.050 IN. MUST EXIST BETWEEN THE WING LOWER BOUNDARY ANGLES AND RIVETS, AND THE HINGE BRACKETS, AND ALSO THE SIDE LINKS.
 3. TO ENSURE UNRESTRICTED MOVEMENT OF CHECK LINKS ABOUT FULCRUM AND PIVOT POINTS THE FOUR SLOTTED NUTS MUST BE FULLY TIGHTENED AND TURNED BACK ONE QUARTER OF A TURN BEFORE DRILLING HOLE IN BOLT FOR SPLIT PIN.
 4. THE LOCKING LEVER BOLT IS TO BE TORQUE LOADED TO 115-125 LBF IN.

FIG.12. CHECK-LINK MECHANISM AND DOOR — REMOVAL AND ASSEMBLY.

◀ ANNOTATIONS ALTERED, NOTE 3 INCLUDED, NOTE 4 ADDED ▶

setting and if necessary adjust (para. 22).

(11) Disconnect the hydraulic test rig and recouple the flexible pipes to the door jack. Bleed the jack (Chap.6).

(12) Functionally test the undercarriage and door (Chap.6).

(13) Ensure that there is a good even fit between the door and undercarriage spat-type fairing.

(14) Check that the door shoot-bolts engage properly and in correct sequence (para.20).

(15) Ensure that all bolts, nuts, pins, and unions are correctly locked.

Door check links (fig.12)

35. The door check link mechanism should not normally require any attention apart from normal periodic lubrication. If, however, it is found necessary to remove and replace parts of, or the whole of, the mechanism, the following assembly points must be noted and functioning checks made. The removal of the mechanism is straight forward and requires no explanation.

Assembly notes and functioning checks:

(1) Jack and trestle the aircraft (Sect.2, Chap.4) and remove the main undercarriage jack lock lever bolt (para.30).

(2) Assemble the side links, but not the slave link. Set the check links and

sequence valve and ensure that the sequence valve plunger is not bottoming (para.22).

Note...

1. A foul may occur between the bolt Ref.No.26FZ/21079, about which the lock lever, side links and lower check links pivot, and the flange of the adjacent sequence-valve bracket. This bolt must be fitted with its head facing aft and, if the foul, still exists the washer under the head of the bolt must be fitted under the nut.

2. When assembling the check links ensure that the two 3/8 in. fulcrum bolts Ref.No.26FZ/21081 are positioned with the heads on the inner faces of the links with the spacing washer between the hinge and the check links and a plain washer fitted under each nut. After fully tightening these nuts and the nuts on the check links upper and lower attachment bolts, screw them back one quarter of a turn before drilling the split-pin hole; this allows for free movement of the links.

(3) Fit the slave link and adjust to the dimensions given on fig.12.

(4) With the door jack disconnected at the lock lever, manually close the door and check that the slave link is free throughout its movement and does not foul the door sealing strip or check link pins. Observe the clearance at the top of the slot and ensure the slot does not 'bottom' during the whole

movement, there must also be adequate clearance at the bottom of the slot when the door is fully up.

(5) Remove the two 3/8 in. bolts from the fulcrum of the check links and ensure that the slave mechanism operates the sequence valve plunger with the door pushed to the fully down position.

(6) Reconnect the door jack to the lock lever and pump the jack fully down. Check that the slave mechanism still operates the sequence valve plunger.

Note...

With the check link fulcrum bolts removed, there will be no clearance between the top of the slave link slot and the eccentric bolt shank when the door is in the down position.

(7) Pull the door in an outboard direction and ensure that the mechanism is firm and that the sequence valve plunger is still depressed.

(8) Refit the bolts in the check links fulcrum points (operation (2) Note (2)) and, observing the quarter turn back of the nuts, fit the split pins.

(9) Finally check that with the door fully down there is still a clearance between the top of the slave link slot and the eccentric bolt shank.

(10) Refit the main undercarriage jack lock lever bolt (para.31).

(11) Function-test the undercarriage (Chap.6).

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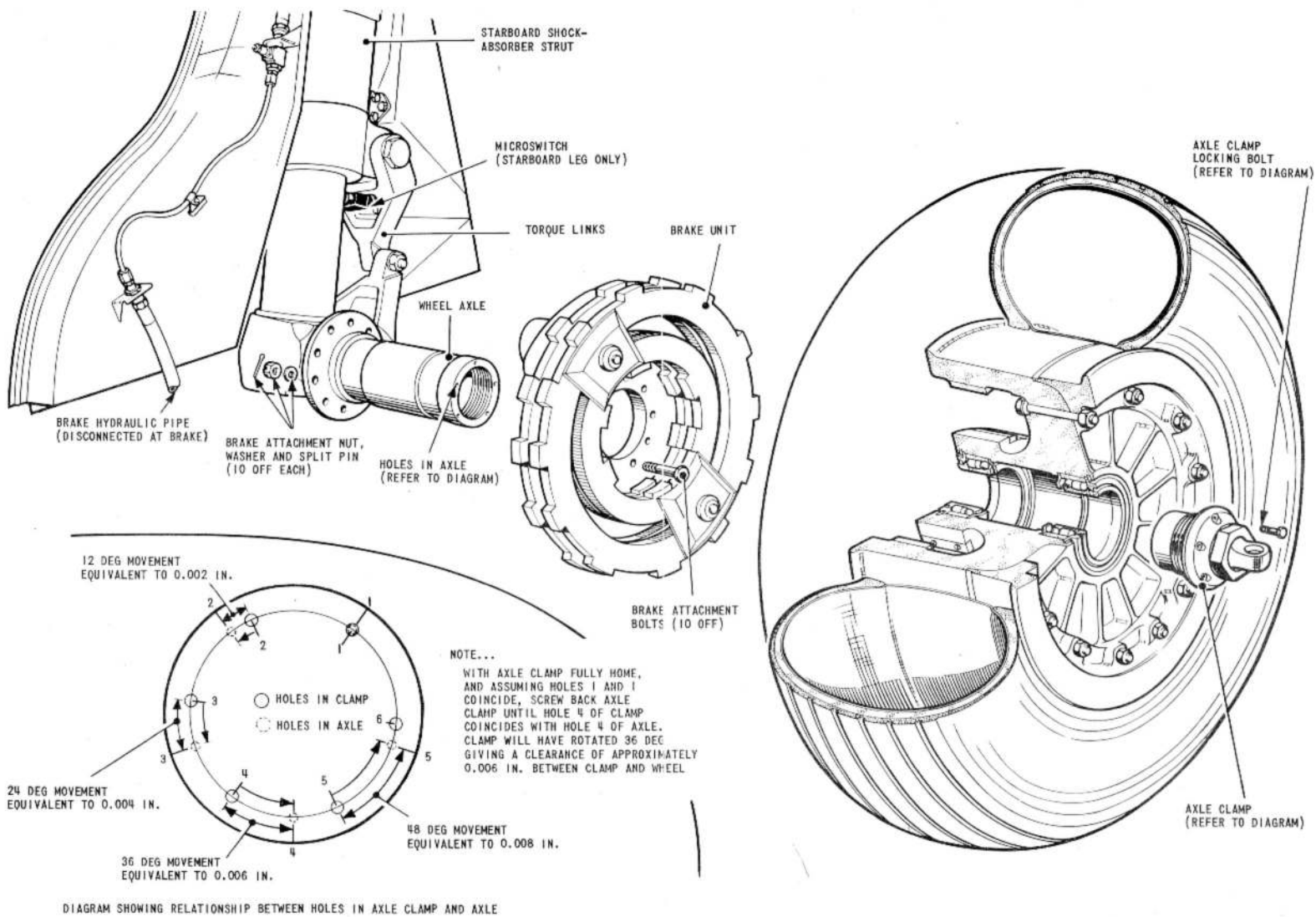


FIG. 13. WHEEL AND BRAKE REMOVAL AND ASSEMBLY

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Door hinges (fig.12)

36. The amount of thread of a hinge bracket attachment bolt which passes into its anchor nut is critical. It is, therefore, important that, during assembly of the hinge brackets one of the following procedures is carefully observed, dependent on the type of bolt fitted.

(1) Bolt A25

Measure the amount of the existing packing and fit the appropriate length of bolt and/or washers selected from the following table:—

PACKING	FASTENING
FWD. HINGE	
Nil	bolt A.25/3C
less than 0.05 in.	bolt A.25/4C and washer SP./15C
0.05 in. to 0.10 in.	bolt A.25/4C
0.10 in. to 0.13 in.	bolt A.25/5C and washer SP./15C
AFT HINGE (top bolt)	
Nil	bolt A.25/2C
less than 0.03 in.	bolt A.25/3C and washer SP./15C
0.03 in. to 0.08 in.	bolt A.25/3C
0.08 in. to 0.13 in.	bolt A.25/4C and washer SP./15C
AFT HINGE (remaining bolts)	
less than 0.07 in.	bolt A.25/3C and washer
0.07 in. to 0.13 in.	bolt A.25/3C

or

(2) Bolt EA3-20-2045

Assemble the main undercarriage door to the forward and aft hinges using 1.05 in. long bolts Part No.EA3-20-2045 adjusting the amount of each bolt plain shank engagement with an appropriate amount of washers (S.P.15/C) beneath each bolt head to obtain a combined thickness of packings, shims and washers as follows:—

Forward hinge	0.15 to 0.20 in.
Aft hinge	0.20 to 0.25 in.

Note . . .

Procedure (1) was introduced by STI/CAN/148. Procedure (2) is required on the current issue of the relevant drawings and has the advantage of constant bolt length.

Wheel (fig.13)**Removal**

37.

- (1) Jack and trestle the aircraft (Sect.2, Chap.4).
- (2) Ensure that the aircraft parking brake is off (Chap.6).
- (3) Unlock the brake piston rods by removing the retaining springs and locking plates. Screw the piston rods in tight.
- (4) Remove the locking wire and unscrew and remove the locking bolt from the axle clamp.
- (5) Unscrew and remove the axle clamp.
- (6) Using wheel extractor Ref. No.26FZ/95292 remove the wheel from the axle.

Assembly

38. When reassembling the wheel it is important that the wheel bearing and brake clearances are correctly adjusted. To obtain these clearances the following sequence of operations must be observed:

- (1) Ensure that the wheel bearings are lubricated with grease (fig.5).
- (2) Slide the wheel on to the axle until it is fully engaged with the brake tenons. Release the brake by unscrewing each piston rod one complete revolution. The wheel should now be free to rotate.
- (3) Whilst rotating the wheel, screw on the axle clamp until the taper bearings are fully home and the clearance is taken up. Do not overtighten the axle clamp during this operation.
- (4) When the axle clamp is fully home and the clearance taken up, unscrew the axle clamp to obtain a clearance of $0.005 \text{ in. } \pm 0.005 \text{ in.}$ between the clamp and the wheel.

Note . . .

Six locating holes for the locking bolt are provided in the axle clamp

and five in the axle, therefore only one of the axle clamp holes will coincide with a hole in the axle at any one time (fig.13). This coincidence will occur at different holes at 12 deg intervals as the axle clamp is rotated. The axle clamp is threaded 16 t.p.i., thus one complete turn of the clamp will give a clearance of 0.0625 in. A movement of 12 deg from one hole coincidence to the next would, therefore, give a clearance of $12/360$ of $1/16 = 0.002$ in. approximately. To obtain the minimum defined clearance the axle clamp must be unscrewed through the coincidence of three holes which will give the correct clearance of 0.006 in.

- (5) Insert the locking bolt into the coinciding holes; tighten and wire-lock.
- (6) Adjust the brake clearance by screwing in the piston rods until resistance to rotation is felt, indicating that the brake clearance is taken up. Slacken each piston rod one complete turn, plus the amount required to re-engage the end of the piston rod with the locking plate. Position the locking plates on the cylinders and retain with the springs (A.P.104J-1039-1).
- (7) Function-test the operation of the brakes (Chap.6).

Brake unit (fig.13)

Removal

39.

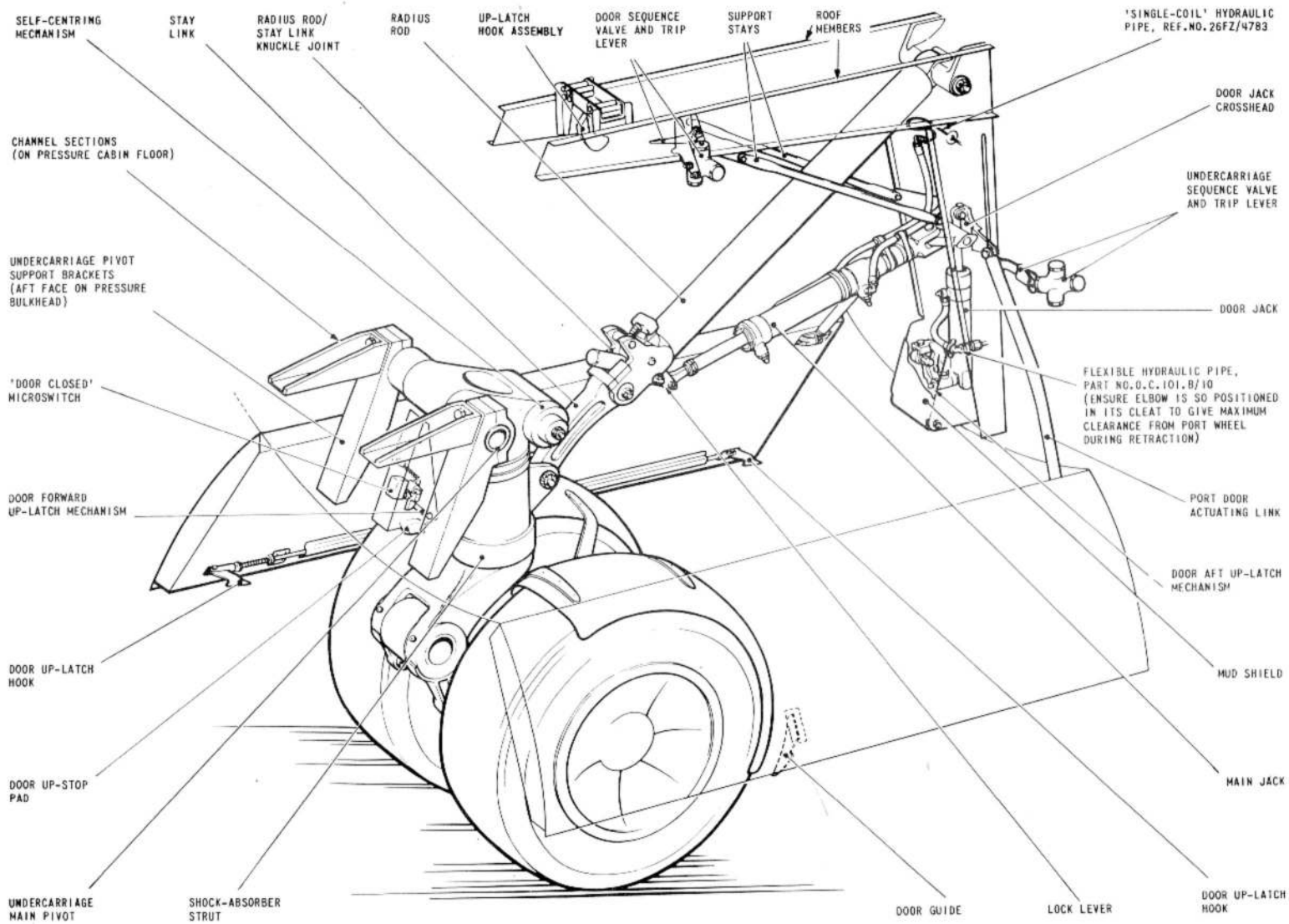
- (1) Jack and trestle the aircraft (Sect.2, Chap.4).
- (2) Ensure that all hydraulic pressure is exhausted (Chap.6).
- (3) Remove the wheel (para.37).
- (4) Disconnect the flexible hydraulic pipe from the brake unit.
- (5) Remove the split pins from the ten slotted nuts which secure the brake unit to the axle.
- (6) Remove the brake unit.

Assembly

40.

- (1) Assemble the brake unit to the stub axle and secure with the slotted nuts and new split pins.
- (2) Bleed and reconnect the hydraulic pipe to the brake unit.
- (3) Refit the wheel and adjust the brake piston rods (para.38).
- (4) Function-test the operation of the brakes (Chap.6).

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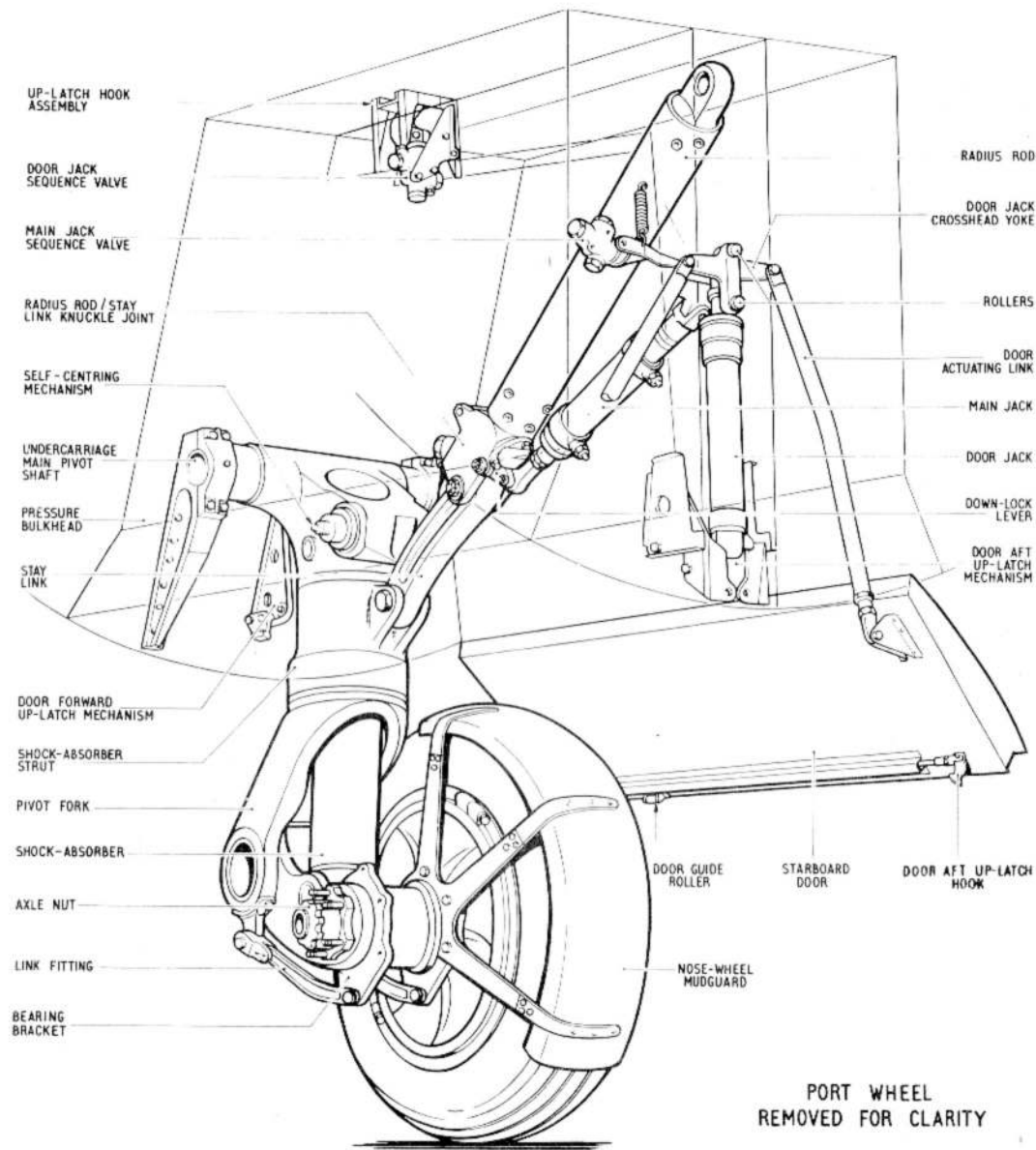


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FIG.1. GENERAL VIEW, LOOKING AFT

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DESCRIPTION



◀ ANNOTATION AMENDED ▶

Fig.2. General view, looking forward

General information (fig.1 and 2)

1. The nose undercarriage is the twin wheel, lever suspension type, fitted with a liquid spring shock-absorber and a spring-loaded self-centring device (A.P.1803E, Vol.1, Sect.6). The unit pivots about support brackets mounted on the aft face of the pressure bulk-head and, on retraction, a hydraulic jack moves it rearwards and upwards into the nose-wheel well (Chap.1). After retraction, the nose wheel is faired-off flush with the aircraft skin by two doors actuated by another hydraulic jack mounted on the aft bulk-head of the well. A mudguard, attached to the bearing bracket on the axle is provided for each wheel. A radius rod and stay link, spanned between the aircraft structure and the shock-absorber, incorporates a down-lock mechanism in its knuckle joint; the undercarriage is held locked in the retracted position by an up-latch hook situated in the roof of the wheel well. Sequence valves, interposed in the hydraulic jacks circuits, ensure correctly-timed opening and closing of the doors in relation to the undercarriage operation (Chap.6).

Shock-absorber strut

2. The strut consists of a main fitting, which houses the main pivot shaft and self-centring mechanism, a pivot fork and link fitting, a twin-stub axle beam, and a liquid-spring shock-absorber. Two bearing-brackets on the aft face of the pressure bulkhead provide a suspension and pivoting point for the strut main pivot shaft, while lugs on

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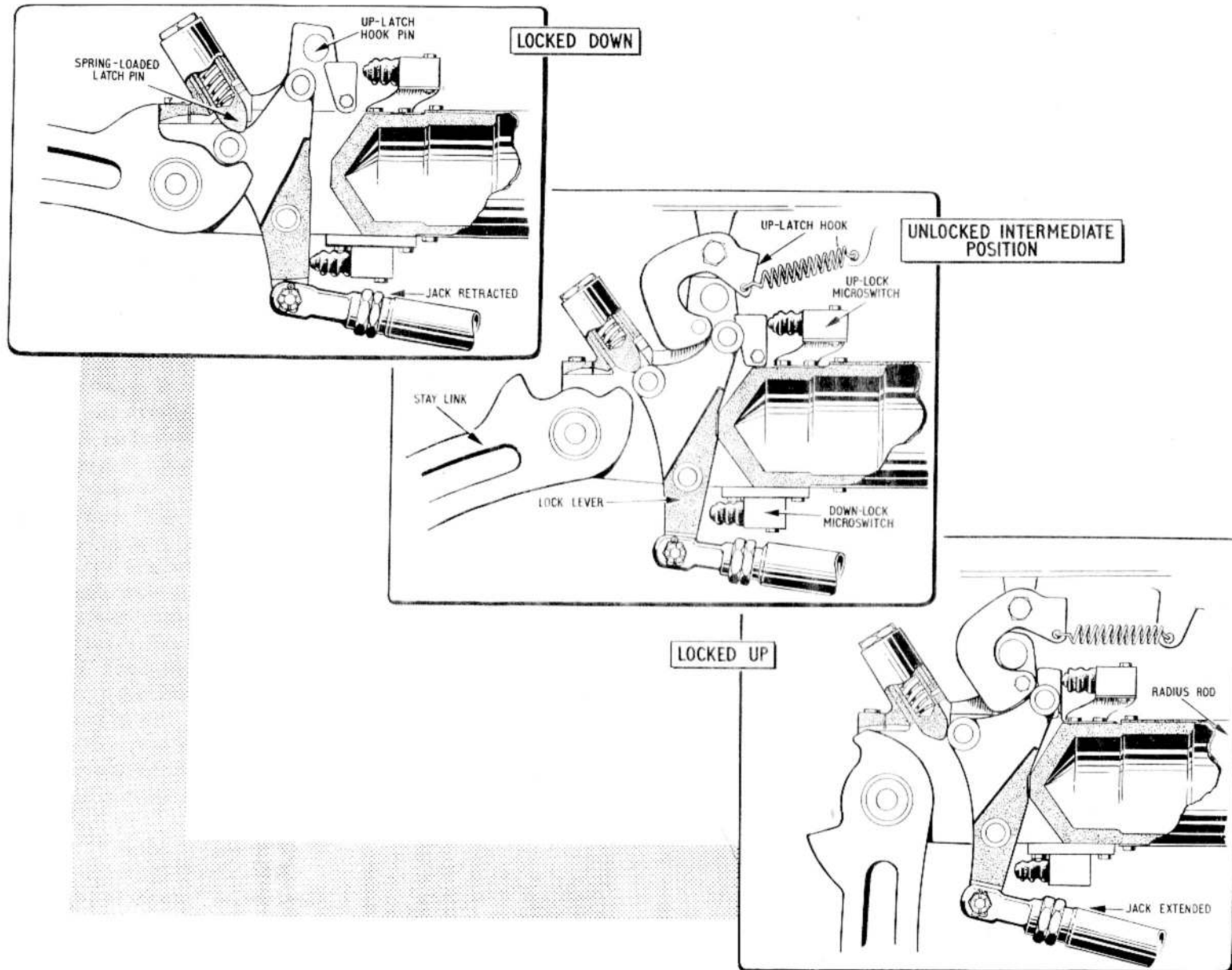


FIG.3. UNDERCARRIAGE LOCKING MECHANISM

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the rear of the strut outer sleeve form attachment points for the stay link which connects the strut to the retracting mechanism (para.5). The wheels are carried on the stub axle beam pivoted to the lower end of the inner sleeve, with the lower end of the shock-absorber strut pin-jointed to the beam between the axle and pivot pin.

Shock-absorber

3. The shock-absorber is a liquid-spring unit housed within the strut outer sleeve and retained in the strut by a pin. It consists of a cylinder, housing a piston assembly, and is described in A.P.1803E, Vol.1, Sect.6.

Self-centring mechanism

4. The spring-loaded self-centring mechanism is an integral part of the strut outer sleeve. It is housed in a dashpot at the top of the sleeve and acts as a damper to any shimmying effect which might occur during taxiing. The unit is fully castering, controlled within a range of 25 deg on each side of the trailing position.

Radius rod and stay link

5. The radius rod pivots at its upper end in a block mounted between two heavy support beams on the underside of the undercarriage well roof, and is pin-jointed at its lower end to the stay link which connects it to the strut outer sleeve. Where the radius rod joins the stay link a knuckle joint is formed which folds during undercarriage retraction. Incorporated in this knuckle joint is the down-lock mechanism and a pin which engages the up-latch hook

when the undercarriage is fully retracted. Two microswitches, which when operated illuminate the undercarriage indicator lights at the pilot's station, are mounted on the knuckle joint.

Undercarriage jack

6. The jack is situated below the radius rod, and at its body end is pivoted between the two channel stiffeners on the aft bulkhead of the undercarriage well. At its forward end the jack piston-rod is attached through the down-lock lever to the knuckle joint of the radius rod. The jack is extended when the undercarriage is retracted.

Up-latch mechanism (fig.8)

7. The up-latch hook assembly is mounted between the two support beams on the underside of the wheel-well roof. The hook is retained in its normal locking position by a spring, one end of which is attached to an extension of the hook, while the other is attached to the support beam. When the undercarriage is fully retracted, the hook, under the action of its spring, engages the up-latch pin on the end of the radius rod; when the jack retracts to lower the undercarriage, the initial movement rotates the down-lock lever and a roller on the end of the lever disengages the up-latch hook from the up-latch pin to release the undercarriage. An adjustable pedestal is mounted on each side of the up-latch hook to limit the upward movement of the radius rod. The door sequence valve and trip lever is mounted just aft of the up-latch hook assembly on the port longitudinal well roof beam; the lever is operated, during under-

carriage retraction, by the upper face of the radius rod.

Down-lock mechanism (fig.3 and 7)

8. The down-lock mechanism is carried in the forked end of the radius rod in which the stay link is hinged. It consists of a lever, mounted on a pivot bolt, carrying two rollers on its upper end; the lower end of the lever is connected to the end of the jack piston-rod. When in the down position, the lower of the two rollers on the lever rests on the profiled end of the stay link, in which position it is locked by a spring-loaded latch pin.

Door-operating mechanism (fig.5)

9. The two doors are hinged to the under-surface of the fuselage, one on either side of the undercarriage well, and open downward and outward. The doors are operated by a jack mounted vertically on the rear bulkhead of the undercarriage well, the upper end of the jack piston-rod being connected to a crosshead yoke which is connected to the rear of both doors by actuating links; the lower end of the jack is connected to the door up-latch hook release lever (fig.4 and 11). A trip screw on the port arm of the crosshead operates, through a lever, the undercarriage jack sequence valve when the doors are opened.

Door-latching mechanism (fig.4)

10. The doors are secured in their closed position by two latches, one at each end of the starboard door, which hook over two up-latch bolts suitably

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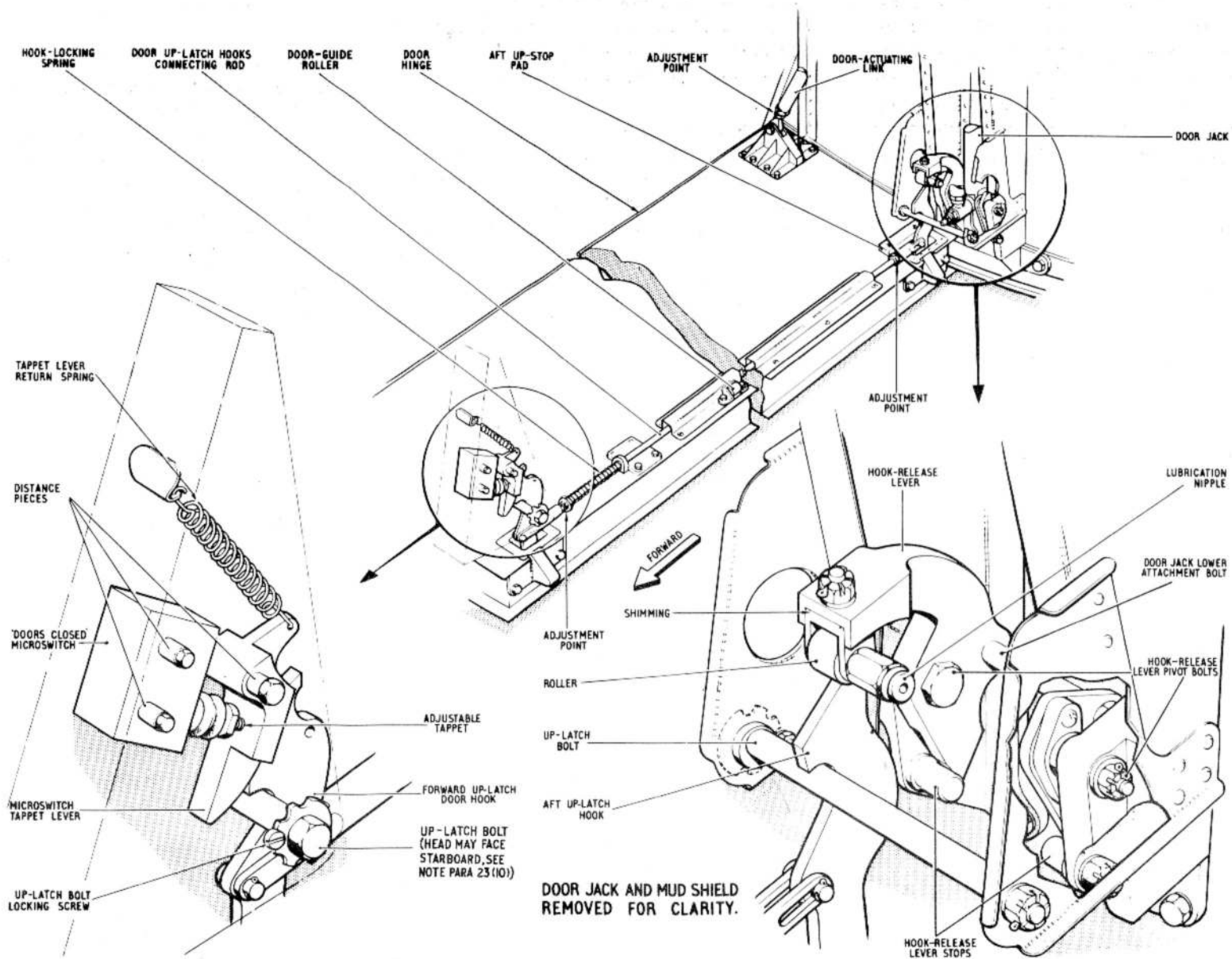


FIG. 4. STARBOARD DOOR LOCKING MECHANISM

◀ STI/CAN/199 INCORPORATED ▶

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positioned on the forward and aft walls of the undercarriage well. The port door is held in the closed position by two bevelled abutment faces (fig.8 and 9), fitted to the edge of the starboard door, which mate with corresponding inverted abutment faces on the edge of the port door. The two door up-latch hooks are connected by an adjustable

rod, and are loaded in the locked position by a latch return spring. Up stops are provided for both doors, one at the front and two at the rear of the undercarriage well; the rear stop packings are on the doors, and all three are adjustable by shimming to ensure a correct fit of the doors to the fuselage. The doors are shaped in such a

manner that the forward ends close first.

11. The doors are opened when the latches are operated by a hook release lever mounted at the rear end of the undercarriage well; the lever is pivoted about its centre, and its upper end carries a striker roller so positioned that downward movement will cause it to contact the upper face of the aft latch. The lever carries the door jack lower pick-up point, and forward swing limit stops are fitted to the lever bracket to contact the lever and ensure a positive operating point for the jack when closing the doors. Initial retraction of the jack gives an upward movement to its lower pick-up point and a forward and downward movement to the hook release lever, which causes the striker roller to contact and move the aft latch out of engagement with its latch bolt. Movement of the aft latch is transmitted by the connecting rod to the front latch which is simultaneously released; further movement of the jack opens the doors. When the doors are being closed, the final movement of the jack brings the upper edges of the latch hooks into contact with the latch bolts and, due to their bevelled shape, the latches are moved rearwards until the doors are fully closed then, under the action of the latch return spring they move forward and lock the doors.

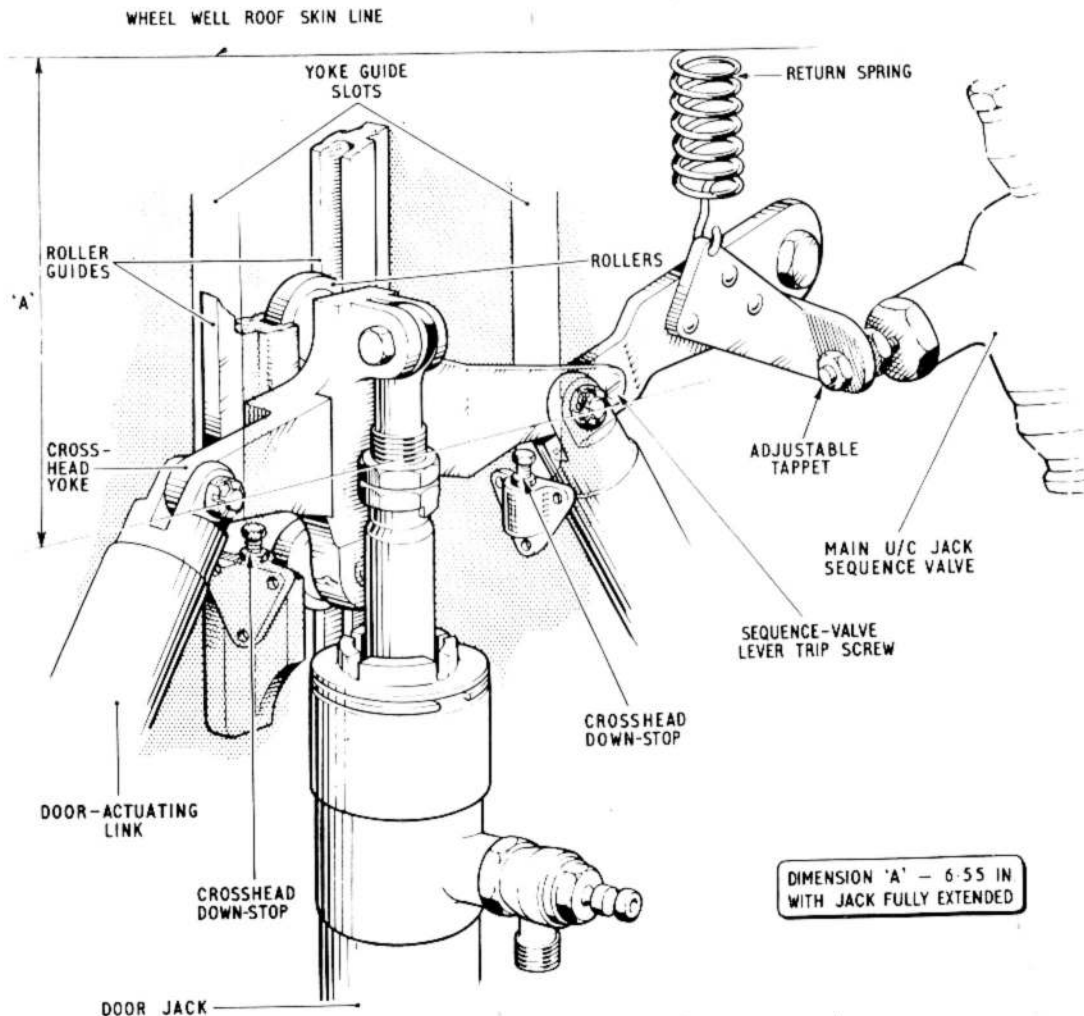


Fig. 5. Door jack crosshead arrangement

Principle of operation

Raising

12. Upon selecting alighting gear UP, hydraulic pressure is first felt at

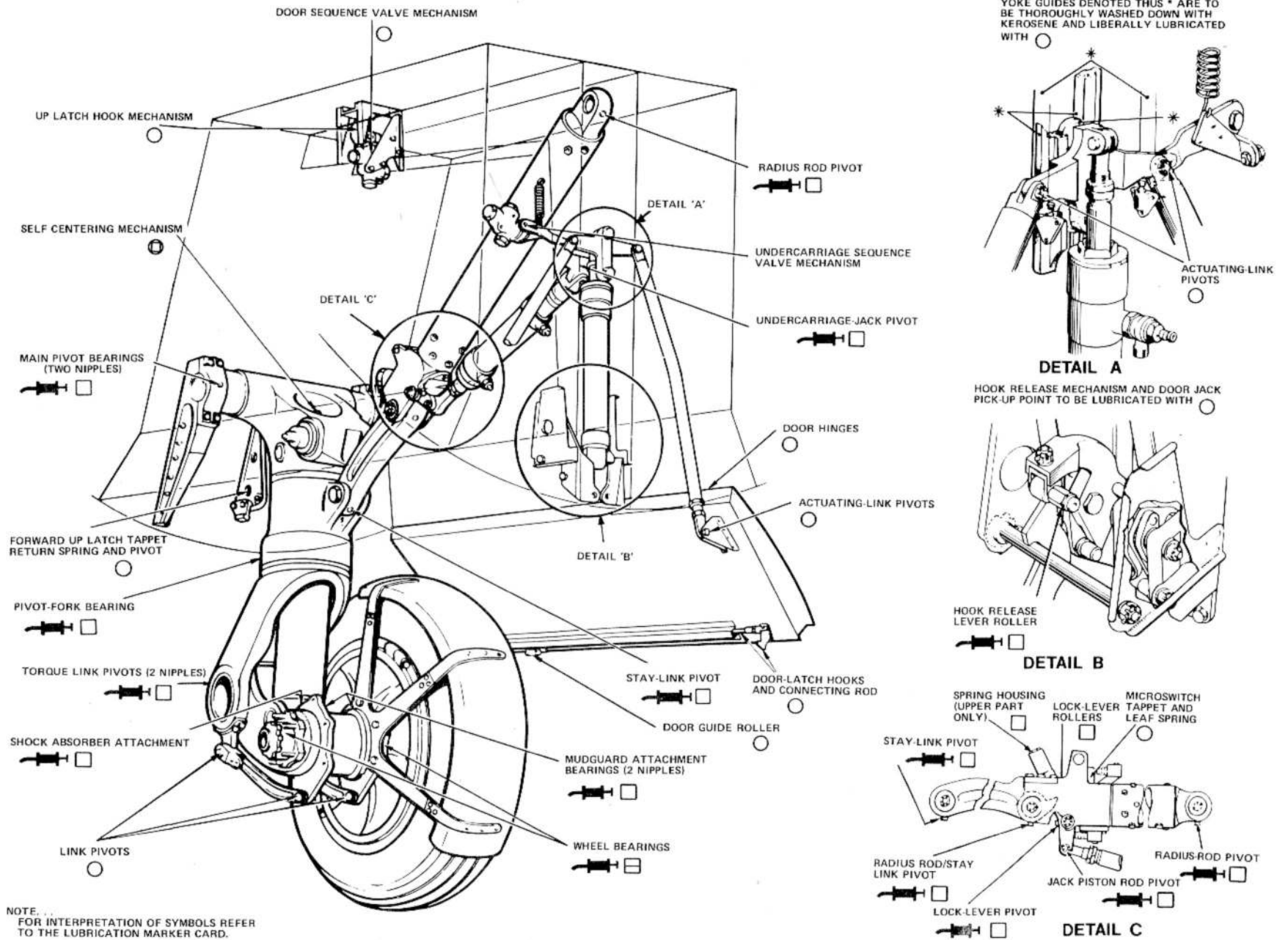


FIG.6. LUBRICATION DIAGRAM

◀ REDRAWN ▶

both the undercarriage and door jacks but, since the door jack sequence valve is closed, preventing a flow of fluid from the door jack, only the undercarriage jack is operated. Initial extension of the jack piston-rod overrides the spring-loaded lock lever plunger and withdraws the lower roller of the lock lever from the profiled end of the stay link (fig.3); further movement breaks the stay link/radius rod knuckle joint, raises the radius rod and retracts the undercarriage. As the undercarriage approaches the end of its movement, the up-latch pin is engaged by the up-latch hook, and the radius rod trips the door sequence valve operating lever, permitting a flow of

fluid from the door jack. Initial extension of the door jack piston-rod closes the undercarriage jack sequence valve, and continued movement of the door jack closes the doors (para.11).

Lowering

13. When the alighting gear is selected DOWN, hydraulic pressure is first felt at both the undercarriage and door jacks but, since the undercarriage sequence valve is closed, preventing a flow of fluid from the undercarriage jack, only the door jack is operated. Initial retraction of the door jack piston-rod operates the door latches (para.11) and continued retraction opens the doors which finally operate the

undercarriage jack sequence valve, allowing fluid to flow from the undercarriage jack. Initial movement of the undercarriage jack causes the lock lever to pivot and disengage the up-latch hook, the radius rod falls and closes the door jack sequence valve and further movement of the jack lowers the undercarriage. The undercarriage is finally locked down by the engagement of the lower roller of the lock lever in the lip on the end of the stay link and the operation of the spring-loaded lock lever plunger (fig.3).

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

General information

14. The following paragraphs provide information on the routine servicing of component parts.

Shock-absorber leakage

15. External leakage from the shock-absorber is an indication of a defective sealing ring or gland washer. In these cases the unit must be considered unserviceable and a new one fitted. If leakage occurs past the bleed plug it may be caused by slackness of the plug or grit under the ball; if cleaning and tightening proves ineffective the unit must be renewed.

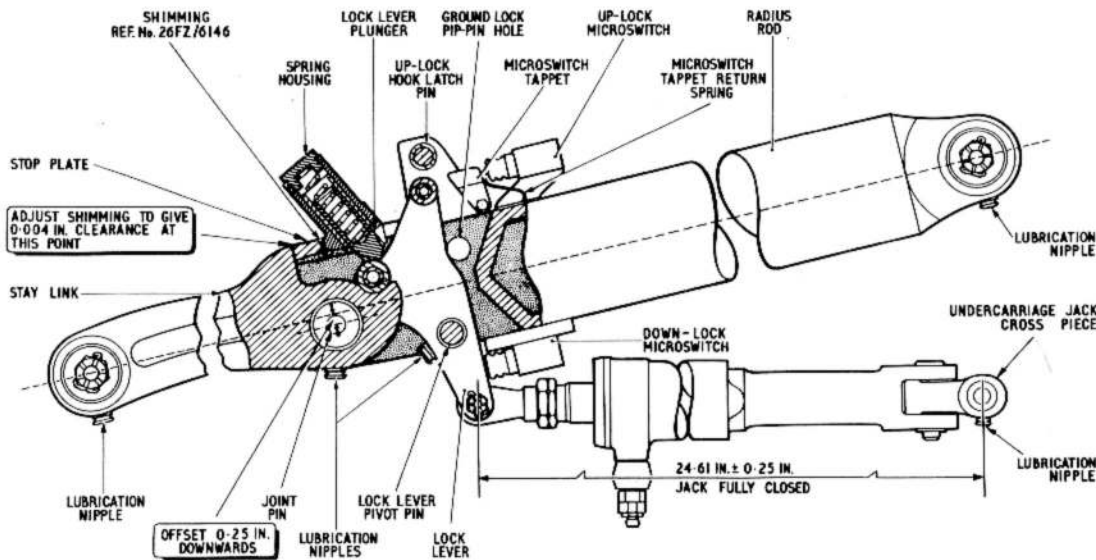


Fig.7. Radius rod/stay link alignment

Checking and correcting shock-absorber oil pressure

16. If the shock-absorber leg extension does not conform to the dimensions given in Sect.2, Chap.2 when the undercarriage is in the normal static-loaded condition and the shock-absorber shows no sign of leakage, the unit must be topped up as follows:-

(1) Jack the aircraft nose (*Sect.2, Chap.4*) to remove the load from the shock-absorber.


(2) Connect a flexible charging adapter Ref.No.27Q/14103 to a universal lubricating gun Ref.No.1B/4467 and prime the charging adapter using hydraulic fluid OM-15.

(3) Remove the cap from the shock-absorber charging valve and connect the primed charging adapter and gun to the valve.

(4) Charge the shock absorber to a pressure of 1500 ± 0.00 lb/in². Release the pressure in the charging adapter by slackening the adapter bleed screw. Remove the adapter and gun; refit the valve cap and lower the aircraft.

(5) Recheck the leg extension dimension (*Sect.2, Chap.2*).

Lubrication

17. Refer to fig.6. 

ADJUSTMENTS**General information**

18. The paragraphs in this section

describe the procedure to be adopted when settings have to be checked and adjustments made. The occasions arise during both servicing and assembly operations and have for that reason been incorporated in this separate section, with relevant cross references made as necessary from other sections. After any adjustments have been made the nose undercarriage must be function-tested (*Chap.6*).

Note...

1. *Operation of the nose undercarriage UP/FLIGHT selector valve to UP isolates the main undercarriage units and prevents them retracting (Chap.6).*

2. *When raising the nose undercarriage with the door-actuating links disconnected from the doors, an assistant must hold and guide the links to prevent damage to the adjacent hydraulic piping.*

Radius-rod and stay-link alignment

(*fig.7*)

19. The radius rod and stay link are in correct alignment when their joint pivot pin is offset 0.25 in. downwards from a straight line between the radius rod pin centre and the stay link pin centre. This dimension can be measured with either the jack connected and under hydraulic pressure or by applying strong upward manual pressure to the radius rod. With hydraulic pressure released, there must be a 0.004 in. clearance between the upper lip of the side stay and the radius rod stop-plate

(*fig.7*). Should adjustment be necessary, either add to, or subtract from, the shimming Ref.No.26FZ/6146 (total pack 0.0625 in. in laminations of 0.002 in.) provided behind the stop-plate, in the following manner:-

(1) Select UP on the UP/FLIGHT selector valve and partly raise the undercarriage by operating the aircraft hand pump.

(2) Remove the stop-plate by unscrewing its securing bolts and adjust the shimming Ref.No.26FZ/6146 as necessary. Refit the stop-plate.

(3) Select FLIGHT on the UP/FLIGHT selector and fully lower the undercarriage by operating the aircraft hand pump.

(4) Release the hydraulic pressure and check that the 0.004 in. clearance has been obtained.

Jack travel adjustments

Undercarriage jack

20. The distance between the pin centres of the undercarriage jack when fully closed is 24.61 ± 0.25 in.; the jack piston-rod travel is 9.09 ± 0.06 in. The exact pin-centre dimension is governed by the pick-up points on the aircraft structure and the radius rod lock lever. The jack length must be checked upon renewal and after any servicing which may have affected its setting. To adjust the length:-

(1) Jack and trestle the aircraft (*Sect.2, Chap.4*).

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(2) Disconnect the jack piston-rod from the lock lever by removing the attachment bolt (para.27).

(3) Disconnect the stay link and radius rod assembly from the shock-absorber strut by removing the stay link lower pivot bolt (para.27).

Note...

The radius rod assembly must not be allowed to fall below its normal operating position whilst disconnected at its lower end, or its underside will foul and damage the rigid 'single coil' hydraulic pipe Ref.No.26FZ/4783 situated on the aft bulkhead immediately below the radius rod upper pivot attachment (fig.1).

(4) Unlock the nose undercarriage UP/FLIGHT hydraulic selector valve (Chap.6), select UP and fully extend the jack by operating the aircraft hand pump.

(5) Loosen the locknut on the jack piston-rod eye-end.

(6) Manually lift the radius rod assembly hard against the up-lock pedestal stops and adjust the length of the jack by screwing the piston-rod eye-end either in or out, until the distance between the jack pin centres exceeds the distance between the centre of the piston rod attachment hole in the lock lever and the centre of the jack attachment bolt in the aircraft structure by 0.18 in. \pm 0.02 in.

Note...

Do not reconnect the jack piston-rod to the lock lever at this stage.

(7) Reconnect the radius rod and stay-link assembly to the shock-absorber strut in the down position. Check the radius rod and stay link for correct alignment (para.19).

(8) Select FLIGHT on the nose undercarriage UP/FLIGHT selector valve, and operate the aircraft hand pump to fully close the jack.

(9) Check that the undercarriage jack hydraulic pipes are so positioned and secured that, during all operations of the jack, they will not foul either the undercarriage door jack crosshead or any part of the structure. The method of positioning and securing the pipes is described and illustrated in fig.17.

(10) With the radius rod assembly locked down and the jack fully closed, check that the distance between the centre of the piston-rod attachment hole in the lock lever and the centre of the jack attachment bolt in the aircraft structure exceeds the jack pin centres by 0.22 in. \pm $\frac{0}{0}$ $\frac{0}{5}$ in.

(11) Check that the lock lever is correctly positioned by inserting the ground lock quick release pip-pin (Sect. 2, Chap.1); remove the pip-pin before continuing with the adjustment.

(12) Select UP on the nose undercarriage

UP/FLIGHT selector valve and, using the aircraft hand pump, extend the jack until its piston-rod eye-end and the holes in the lock lever coincide. Fit and lock the pivot bolt (para.31).

(13) Tighten and wire-lock the jack piston-rod locknut.

(14) Reselect the UP/FLIGHT selector valve to FLIGHT and wire-lock. Fully close the jack. Check that the clearance between the radius rod stop-plate and the lip of the side stay is 0.004 in. (fig.7). Should adjustment be necessary refer to para.19.

Door jack

21. The distance between the pin centres of the door jack when fully closed must not exceed 16.21 in. \pm 0.25 in., the jack piston-rod travel is 9.19 in. \pm 0.06 in. The exact pin centres dimension is obtained by measuring from the undercarriage well roof to the door actuating link pin centres on the jack crosshead; this dimension is 6.55 in. when the jack is fully extended (fig.5, dimension A). The jack closed position is governed by the setting of the crosshead stops. On replacement of the jack or after any servicing which may have affected its setting, the jack length must be checked and, if necessary, adjusted in the following manner:-

(1) Disconnect the undercarriage jack from the radius rod lock lever and the aircraft structure and remove the jack

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(para.27). Disconnect the door actuating links from the door (para.28).

◀(2) Select UP on the nose undercarriage UP/FLIGHT selector valve, and fully extend the door jack.

(3) Release the jack piston-rod locknut and remove the piston-rod eye-end connecting bolt from the crosshead.

(4) Adjust the jack length by turning

the eye-end one half turn at a time, reinserting the connecting bolt, but not locking it and, with a straight edge placed across the pin centres of the two door actuating link attachment bolts on the crosshead, measure a vertical dimension to the skin of the well roof. Adjust until a vertical dimension of 6.55 in. is obtained (fig.5, dimension A).

(5) Tighten and wire-lock the piston-rod locknut.

(6) Lock the slotted nut to the jack piston-rod connecting bolt with a split pin.

(7) Reconnect the door actuating links.

(8) Adjust the crosshead stops until the doors are at their fully open position; 54.50 in. \pm 0.50 in. measured between the outer edges of their outer skins.

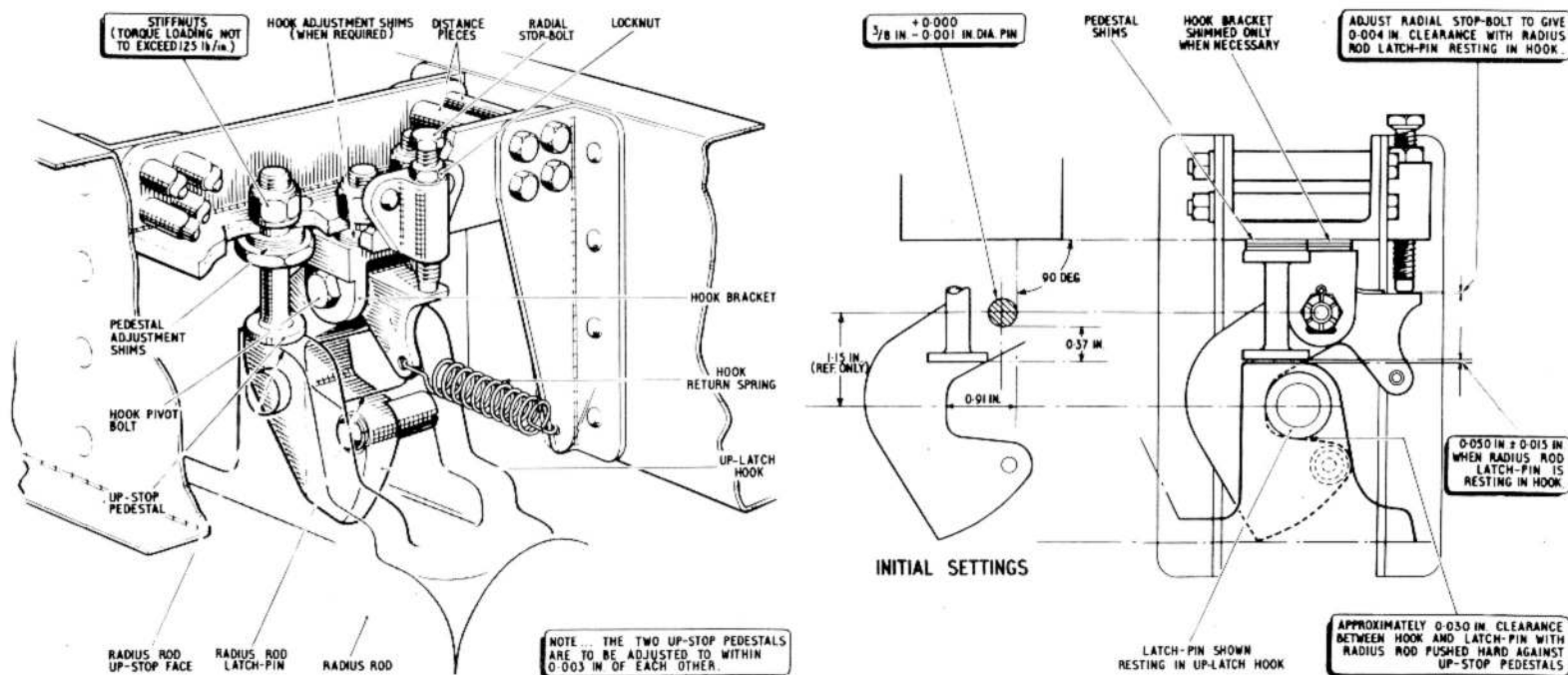


Fig. 8. Up-latch hook setting (1)

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(9) Refit the undercarriage jack to the aircraft (para.31).

Note...

Ensure that the flexible hydraulic pipe Part No.OC.101B/10 (fig.1) which runs to the top of the door jack, is positioned in its cleat on the mud shield so as to give the maximum possible clearance between its elbow union and the port wheel tyre during nose undercarriage retraction.

Up-latch mechanism (fig.8)

22. The following information covers the installation of a replacement up-latch hook and/or bracket assembly. It will be evident that the whole procedure is not necessary for a normal check of the hook setting, but the additional information relating to the initial hook setting has been incorporated to cover cases of extreme maladjustment, when the complete procedure must be adopted. To assemble the up-latch mechanism:-

(1) Jack and trestle the aircraft (Sect.2, Chap.4).

(2) Remove the mudguards and wheels (para.27).

(3) Disconnect the door-actuating links from the doors.

(4) Disconnect the jack-piston-rod from the radius rod lock lever (para.27).

Note...

The radius rod assembly must not be

allowed to fall below its normal operating position whilst disconnected at its lower end or its underside will foul and damage the rigid 'single-coil' hydraulic pipe Ref.No.26FZ/4783 situated on the aft bulkhead immediately below the radius rod upper pivot attachment (fig.1).

(5) Remove the pivot pin attaching the radius rod stay link to the undercarriage strut (para.27).

(6) Remove the cover box of the up-latch mechanism from the floor of the upper equipment compartment. Remove the hook and bracket assembly and the up-stop pedestals and discard the un-serviceable item. Retain the shims and fastenings, less split pins.

(7) Assemble the hook bracket, less shims, to the well roof structure and secure with a stiffnut.

(8) Assemble the up-stop pedestals,

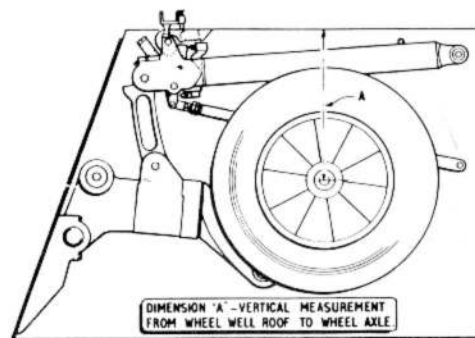


Fig.9. Up-latch hook setting (2)

complete with shims, and secure with stiffnuts.

Note...

The torque loading on the hook and pedestal stiffnuts must not exceed 125 lb in.

(9) Refer to fig.8 and, with a $\frac{3}{8}$ in. $\pm \begin{smallmatrix} 0.000 \\ 0.001 \end{smallmatrix}$ in. dia. pin inserted in the hook pivot bracket, set the hook and pedestals to the dimensions given in the illustration. Attach the hook and connect the hook spring.

(10) Manually raise the radius rod until the latch pin rests in the hook.

(11) Adjust the radial stop-bolt to give a clearance of 0.004 in. between the end face of the radial stop-bolt and the hook flat. Tighten the radial stop-bolt locknut.

(12) With the latch-pin still resting in the hook, adjust the up-stop pedestals to give a clearance of 0.050 in. ± 0.015 in. between the pedestals and the radius rod stop faces.

Note...

1. If the 0.050 in. clearance cannot be attained after the removal of all the shims from beneath the up-stop pedestals, shims must be inserted beneath the hook bracket and, if necessary, further adjustment obtained by reshimming the up-stop pedestals.

2. The two up-stop pedestals are to

be adjusted to within 0.003 in of each other.

(13) Manually push the radius rod hard up against the up-stop pedestals and support it in that position.

(14) Check, and if necessary adjust, the jack override (para.20). Connect the jack to the radius rod lock lever (para.31).

◀ (15) Select the UP/FLIGHT selector valve to UP and, by using the aircraft hand pump, force the radius rod against the up-stop pedestals and adjust the sequence valve (para.24). ▶

(16) Disconnect the jack from the lock lever, lift the radius rod clear of the hook and lower by hand to reconnect the stay link to the undercarriage strut (para.31). Check that the radius rod lock lever is engaged.

◀ (17) Select the UP/FLIGHT selector valve to FLIGHT and fully close the jack under pressure. ▶ Check its closed override (para.20) and connect the jack to the lock lever (para.31).

(18) With the wheels or an equivalent weight fitted to the undercarriage stub axles, raise the undercarriage under hydraulic pressure.

(19) Take and record a vertical measurement from a point in the roof of the wheel well to the undercarriage stub axle (fig.9, dimension A).

(20) Place a jack or trestle beneath the strut allowing a clearance of approximately 1 in. between the strut and the jack or trestle.

(21) Using the aircraft hand pump, lower the door jack until its crosshead trips the undercarriage

sequence valve. An audible click will be heard when the radius rod latch-pin drops into the well of the up-latch hook. When this occurs, stop pumping immediately, leaving the undercarriage suspended by the up-latch hook.

(22) Take a second measurement from the same point in the roof, to the nosewheel axle (fig.9, dimension A); this dimension should exceed that obtained in operation (19) by 0.20 in. ± 0.050 in. If this dimensional difference is incorrect, it can be corrected by adjusting the shimming beneath the up-stop pedestals.

Note...

The 0.20 in. ± 0.050 in dimension ensures that, with the radius rod hard up against the up-stop pedestals, a gap of approximately 0.030 in exists between the latch-pin and the hook.

(23) Function-test the nose undercarriage and ensure that the hook engages correctly with the latch pin. Recheck the sequence-valve setting and the jack overrides.

(24) Refit the box cover over the up-latch mechanism in the upper equipment compartment.

(25) Reconnect the door actuating links and ensure all nuts, pins and unions are correctly locked.

Door-latching mechanism (fig 10 and 11)

23. The correct setting of the doors in the up position depends upon the critical setting of several adjustable items, namely; the forward and aft door up-latch hooks and connecting rod, the door up-stop pads, abutment faces, and the door actuating links. Any item which is mal-adjusted can affect the setting of each of the

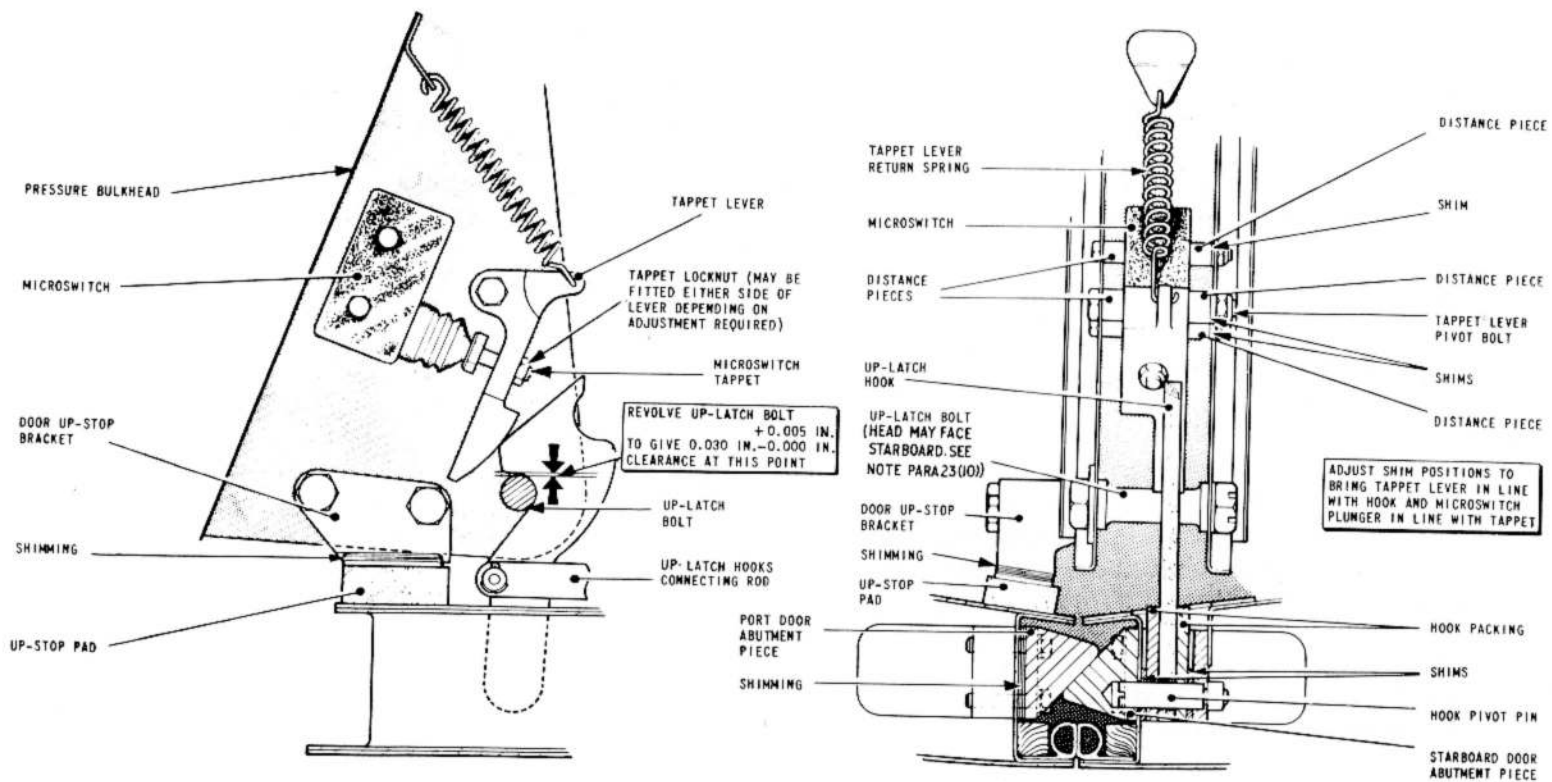


FIG. 10. DOOR FORWARD UP-LATCH HOOK SETTING

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other items; for this reason the following procedure must be adopted, as the sequence in which the settings are made is as important as the settings themselves. To set the nose under-carriage doors:-

- (1) Jack and trestle the aircraft (Sect.2, Chap.4).
- (2) Remove, and mark for reidentification, both door actuating links.
- (3) For ease of access remove the landing wheels and mudguards.
- (4) Fully retract the undercarriage.
- (5) Remove and retain the packing and shimming from the up-stop on the forward up-latch bolt attachment bracket.
- (6) Manually close the starboard door and align its trailing edge flush with the fuselage contour by adding or subtracting shims at the aft up-stop pad (fig.11). Hold the door firmly in the closed position and obtain a 0.030 in 'out-of-wind' step at the door leading-edge by inserting a Paxalin wedge (of local manufacture), between the door inner-skin and the starboard lower edge of the forward up-latch bolt mounting bracket.

Note...

The door is designed to close at its forward end first.

- (7) Adjust the up-latch hooks connecting rod on the starboard door so that the hooks will fully engage over the up-latch bolts. Remove the Paxalin wedge.

- (8) Support the front edge of the door in the up position and check that the forward hook is in line with the microswitch tappet lever, and that the tappet is in line with the microswitch plunger.

- (9) Should it be necessary to align the tappet and/or the microswitch, lateral adjustment can be gained on both items by repositioning the shims fitted on the attachment bolts between the distance pieces and the brackets (fig.10).

Note...

It is permissible to fit the shims equally on each side of the distance pieces, or both at any one side depending upon the adjustment required. In extreme cases of mal-adjustment, a similar arrangement is permissible with the hook pivot pin shims (fig.10).

(10) Check the hook clearance between the forward up-latch hook and the up-latch bolt (fig.10). If adjustment is required, remove the locating screw from the scalloped head of the up-latch bolt (fig. 4) and revolve the bolt until the correct clearance is obtained. Refit the locating screw.

Note. . .

If scalloped head of the up-latch bolt has been fitted to starboard, then it should be secured as follows (S.T.I./Can/199):-

(a) Obtain a 4BA thick washer (S.P.16/B, 28W/9419486) and enlarge its hole using a 4.8mm (3/16in.) drill.

(b) Insert a 2BA round head bolt (AS1246/1/C, 28D/3140202) with its head inboard of starboard latch bracket.

(c) Fit the 4BA thick washer over the bolt so that it seats in the scallop.

(d) Secure, using a spring washer (SP47/C, 28W/9416643) and nut (A27-CT, 28M/1006473).

(11) Check, and if necessary, adjust the forward up-latch microswitch tappet (fig.13).

(12) With the starboard door still closed, check the clearance of the aft up-latch mechanism:-

(a) The hook should be in line with the centre of the hook release lever roller to within 0.10in.

(b) If, after renewal of a starboard

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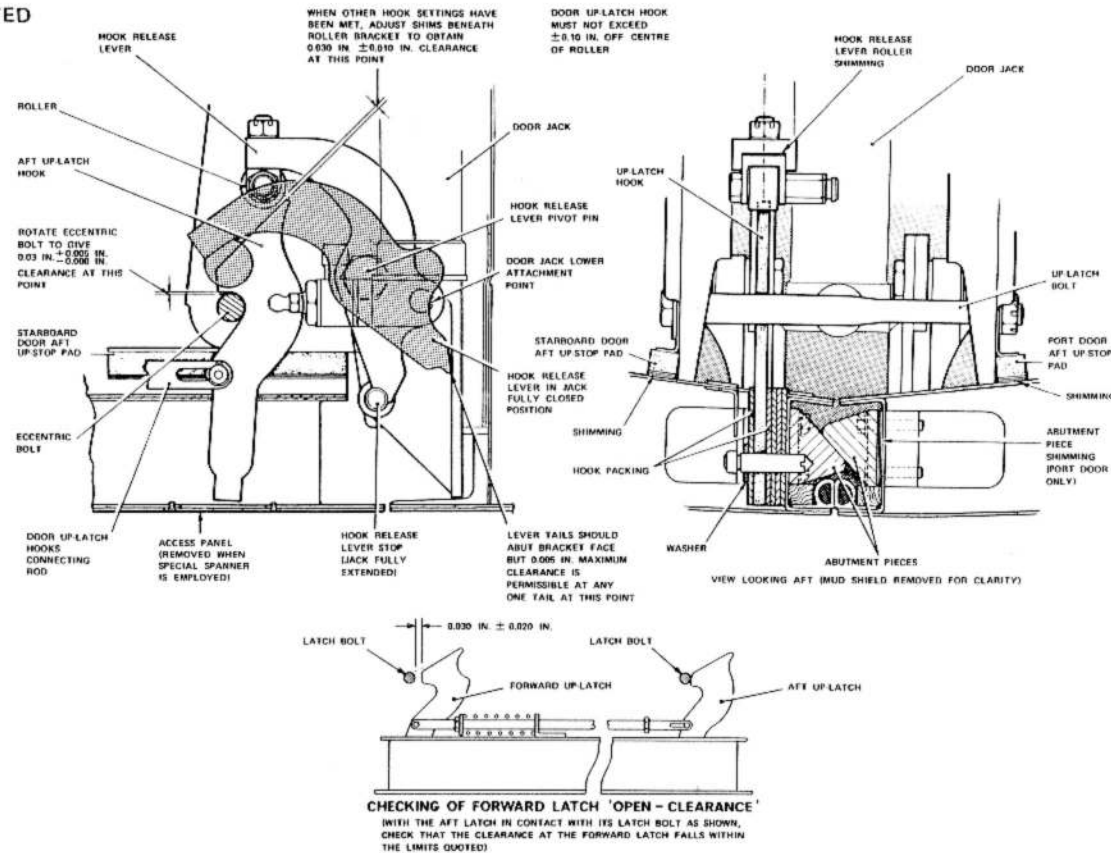


FIG. 11. DOOR AFT UP-LATCH HOOK SETTING

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door, hook, or hook release lever mechanism, it is found necessary to make adjustments to obtain this alignment:-

(i) Remove the abutment piece and the hook assembly from the door; retain the washer (fig.11).

(ii) Drill out the five rivets attaching the packing to the hook.

(iii) Reassemble the packing to the hook to suit the alignment of the hook and hook release lever roller.

(iv) Rivet the packing to the hook and reassemble the hook assembly to the door, fitting the washer removed in operation (i). Refit the abutment piece.

Note . . .

The washer Ref.No.28W/9419476 may be filed to give free fore-and-aft movement of the hook, without allowing any side play (fig.11).

(c) Check the clearance between the aft up-latch hook and the aft up-latch bolt (fig.11). If adjustment is required, remove the locating screw from the scalloped head of the up-latch bolt, and revolve the bolt until the correct clearance is obtained. Refit the locating screw.

(d) When all other aft latch mechanism settings have been met, check the clearance between the flat portion of the hook lip, (the tip has a radius of 0.05 in.) and the hook release lever roller (fig.11). If adjustment is required, remove the slotted nut which secures the roller housing to the hook release lever, and add or subtract shims Part No.EA3.10.3339 as necessary to a maximum shim thickness of 0.20 in. (nominal thickness 0.080 in.).

Note . . .

If, after adjusting the hook release lever roller, the roller attachment nut fouls the adjacent vertical stiffener when the lever is moved aft, the stiffener may be filed locally to clear (max. depth 0.20 in.). Protective treatment (A.P.119A-0509-1) must be applied to all filed surfaces.

(e) Wedge the sequence valve on the bulkhead in the open position, i.e. tappet away from plunger and, remove the sequence valve lever trip screw from the port arm of the jack crosshead. **THIS IS IMPORTANT.**

(f) Ensure that the crosshead down-stops are correctly set (para.21) and fully close the jack. The two tails of the hook release lever should abut the lever bracket, but a maximum gap of 0.005 in. is allowed at any one tail (fig.11).

(13) Slightly open the starboard door and check the 'open-clearance' of the forward up-latch

hook (fig.11). Manually raise the port door and adjust the up-stop pad at the aft end until the door leading edge is 0.030 in. inside the fuselage contour, 'out-of-wind'. With the aft up-stop correctly set, refit the forward up-stop packing removed in operation (5) and shim to suit the 0.030 in. condition.

(14) Close both doors and, with pressure applied to the starboard door, check that the doors fit flush with each other and that their leading edges are 0.030 in. inside the fuselage contour 'out-of-wind'. If the doors do not fit flush with each other adjust the shims beneath the port door abutment pieces (fig.10 and 11).

Note . . .

The door up-latch hooks can be released when the doors are locked up by removing the small access panel from below the aft hook in the door skin, and operating the hook tail with key Ref.No.26FZ/95493.

(15) Ensure the door jack is fully extended and fit the starboard door actuating link; adjust the link if necessary by turning the link eye-end until, with the port door closed manually, the doors fit as in operation (14). Tighten the link locknut and remove the link.

(16) Fit the port door-actuating link and adjust the link if necessary as in operation (15), until the condition described in operation (14) is obtained. Tighten the actuating link locknut and split pin the attachment bolts.

(17) Close the door jack and refit and lock the starboard door actuating link.

(18) Support the undercarriage and remove the wedge from the sequence valve on the bulkhead. Refit the sequence valve lever trip-screw to the port arm of the door jack crosshead.

(19) Hydraulically lower the undercarriage (Chap.6).

(20) Refit the landing wheels and mudguards.

(21) Hydraulically raise the undercarriage, and check that the doors fit correctly and that the 0.030 in. 'out-of-wind' condition is maintained.

(22) Check that the door microswitch functions correctly (fig.13).

(23) Check all skin gaps around both doors (A.P.101B-0400-6, Part 1).

(24) Function-test the undercarriage (Chap.6).

Sequence-valve settings (fig.12)

24. The sequence-valve lever tappets are adjusted to a 0.15 in. dimension measured from the striking face of the tappet and the body of the valve when the lever is in its fully operated position. After any adjustments to the sequence-valve setting a functional check of the undercarriage must be made (Chap.6).

Microswitch settings (fig.13)

25. Following any servicing or component replacement which may have affected the

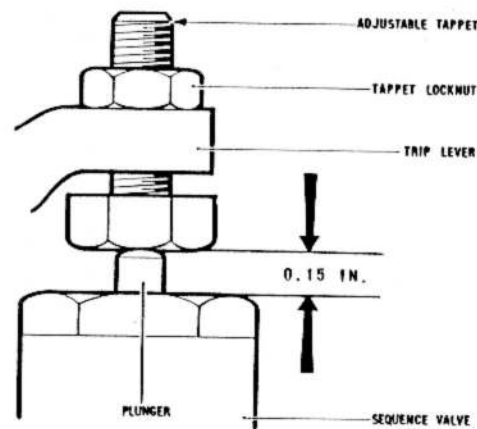
microswitch settings, a thorough check and, if necessary, resetting must be made as detailed in fig.13.

REMOVAL AND ASSEMBLY

General information

26. The following paragraphs detail the removal and assembly operations for the nose undercarriage and its main components. Items which do not require special instructions for removal or assembly are not included. The sequence of operations for assembling the undercarriage must be adhered to, and checks and subsequent adjustments are to be made at the stated operation.

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NOTE... TAPPET LOCKNUT MAY BE POSITIONED EITHER SIDE OF TRIP LEVER DEPENDING UPON THE AMOUNT OF ADJUSTMENT REQUIRED.

Fig.12. Sequence-valve setting

Undercarriage and undercarriage doors mechanism removal (fig.14, 15 and 16)

Note...

The undercarriage and doors mechanism can be removed independently of each other.

Undercarriage

27.

(1) Jack and trestle the aircraft (Sect.2, Chap.4).

(2) Exhaust all hydraulic pressure (Chap.6).

(3) Remove the three bolts and washers securing each mudguard to its bearing bracket and remove the mudguards.

(4) Remove the six stiffnuts and washers securing each landing wheel to its axle and remove the wheels.

(5) Disconnect the hydraulic fluid pipes from the undercarriage jack and blank off the pipe ends and jack apertures (Chap.6).

(6) Remove the clamps and blocks from the jack body (fig.17) and release the hydraulic fluid pipes.

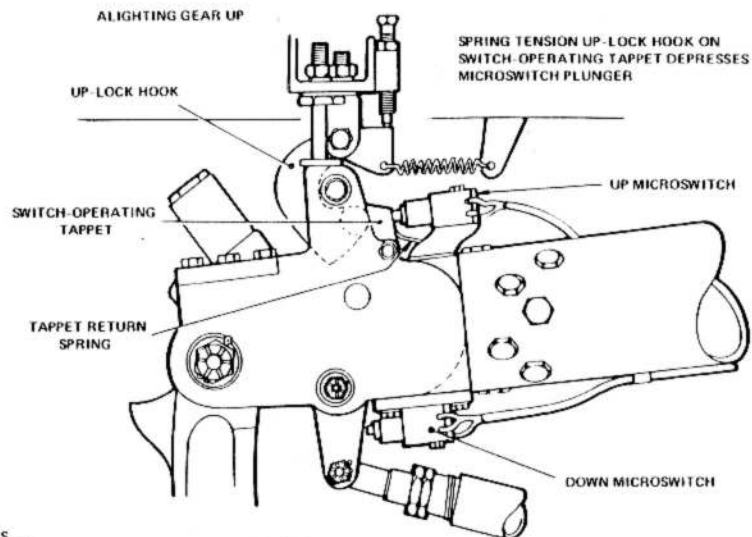
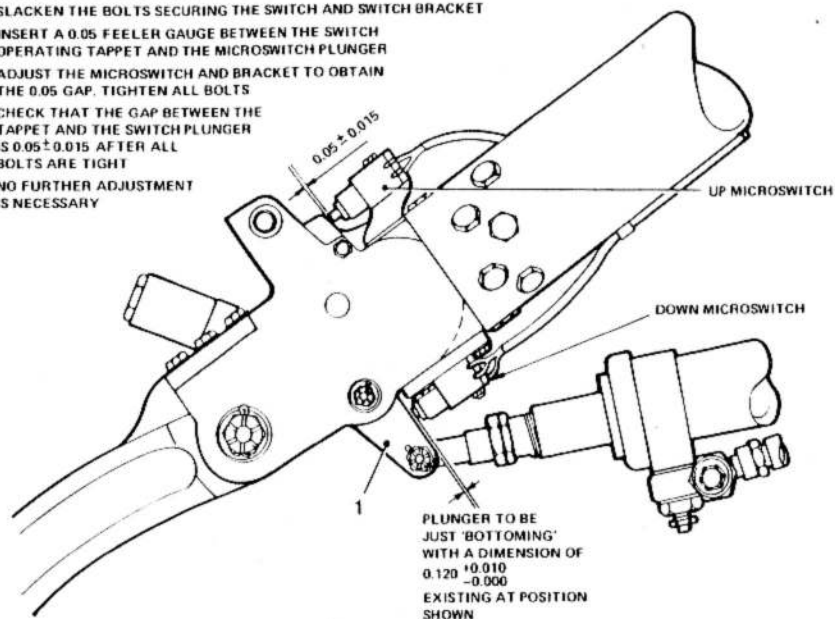
(7) Remove the split pin and slotted nut from the jack piston-rod pivot pin and withdraw the pivot pin (fig.15, detail C).

(8) Remove the split pin, slotted nut and washer from the jack crosspiece pivot between the two channel members

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UP MICROSWITCH ADJUSTMENT WITH U/C IN THE DOWN POSITION

1. SLACKEN THE BOLTS SECURING THE SWITCH AND SWITCH BRACKET
2. INSERT A 0.05 FEELER GAUGE BETWEEN THE SWITCH OPERATING TAPPET AND THE MICROSWITCH PLUNGER
3. ADJUST THE MICROSWITCH AND BRACKET TO OBTAIN THE 0.05 GAP. TIGHTEN ALL BOLTS
4. CHECK THAT THE GAP BETWEEN THE TAPPET AND THE SWITCH PLUNGER IS 0.05 ± 0.015 AFTER ALL BOLTS ARE TIGHT
5. NO FURTHER ADJUSTMENT IS NECESSARY

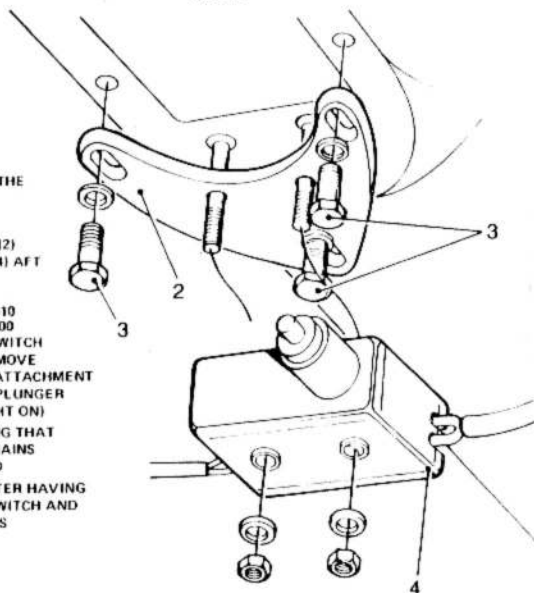


NOTES...

1. AFTER ANY MICROSWITCH ADJUSTMENT AN UNDERCARRIAGE RETRACTION TEST MUST BE MADE AND THE WARNING LIGHTS CHECKED
2. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE STATED

DOWN MICROSWITCH ADJUSTMENT U/C IN DOWN POSITION

1. CONNECT A 24 VOLT SUPPLY TO THE EXTERNAL SUPPLY SOCKET
2. SLACKEN THE BOLTS (3)
3. MOVE THE ATTACHMENT PLATE (2) COMPLETE WITH MICROSWITCH (4) AFT TO THE LIMIT OF ITS TRAVEL (GREEN LIGHT OFF)
4. WITH A DIMENSION OF $0.120 +0.010 -0.000$ EXISTING BETWEEN THE MICROSWITCH PLUNGER AND LOCK LEVER (1). MOVE THE MICROSWITCH (4) AND THE ATTACHMENT PLATE (2) FORWARD UNTIL THE PLUNGER IS JUST BOTTOMING (GREEN LIGHT ON)
5. TIGHTEN THE BOLTS (3) ENSURING THAT SOME PLUNGER MOVE MENT REMAINS WHEN ADJUSTMENT IS FINALISED
6. RE-CHECK THE ADJUSTMENT AFTER HAVING FINALLY REFITTED THE MICROSWITCH AND TIGHTENED THE SECURING BOLTS



DOOR MICROSWITCH ADJUSTMENT

1. JACK THE NOSE (SECT.2, CHAP.4)
2. CONNECT A 24 VOLT SUPPLY TO THE EXTERNAL SUPPLY SOCKET
3. DISCONNECT THE PORT DOOR ACTUATING LINK (FIG.1) AT IT'S LOWER END
4. UNLOCK AND SELECT THE NOSE UNDERCARRIAGE UP/FLIGHT SELECTOR TO UP. USING THE HAND PUMP, FULLY RAISE THE NOSE WHEEL, ENSURING THAT THE DISCONNECTED LINK IS HELD CLEAR
5. SLACKEN THE TAPPET LOCKNUT (6)
6. SCREW TAPPET (6) AWAY FROM THE MICROSWITCH (7) (RED LIGHT ON)
7. SCREW TAPPET (5) TOWARDS THE MICROSWITCH (7) UNTIL A DEFINITE CLICK IS HEARD (RED LIGHT OFF) AND GIVE A FURTHER TWO COMPLETE TURNS
8. TIGHTEN THE LOCKNUT (6) AND ENSURE THAT SOME PLUNGER MOVEMENT STILL REMAINS
9. SELECT THE NOSE UNDERCARRIAGE UP/FLIGHT SELECTOR TO FLIGHT. USING THE HAND PUMP, FULLY LOWER THE NOSE WHEEL, ENSURING THAT THE DISCONNECTED DOOR LINK IS HELD CLEAR. WIRE LOCK THE UP/FLIGHT SELECTOR IN THE FLIGHT POSITION
10. RECONNECT THE PORT DOOR ACTUATING LINK

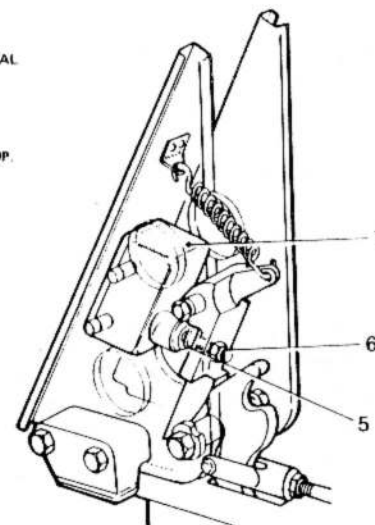


FIG.13 MICROSWITCH ADJUSTMENT - NOSE UNDERCARRIAGE

◀ 'DOWN' MICROSWITCH ADJUSTMENT DIMENSIONS AMENDED ▶

on the aft bulkhead, and withdraw the pivot pin (fig. 15, detail E).

Note...

1. Two SP.13/L plain washers Ref.No. 28W/9419467 are fitted one at each side of the jack pivot between the jack crosspiece and the vertical channel members.

2. Some aircraft have flanged bushes riveted to the vertical channel members. These were fitted by the manufacturers to rectify oversize rivet holes and each is equivalent in thickness to washer Ref.No.28W/9419467.

(9) Remove the jack.

(10) Disconnect the electrical cables from the two microswitches on the radius rod knuckle joint (A.P. 101B-0417-1B, Sect. 6, Chap. 5) remove the three cable clips from the radius rod tube, and coil and stow the cables in the roof of the wheel well.

(11) Remove the split pin, slotted nut and special washer from the stay link pivot pin on the shock-absorber strut (fig. 15, detail D).

(12) Remove the locating grub screw from the head of the stay link pivot pin and, using an extractor, withdraw the pivot pin. Support the radius rod assembly.

Note...

The radius rod assembly must not be allowed to fall below its normal operating position or its underside will foul and damage the 'single-coil-shaped' rigid hydraulic pipe situated on the aft bulkhead immediately below the radius rod upper pivot attachment (fig. 1).

(13) Remove the split pin, slotted nut

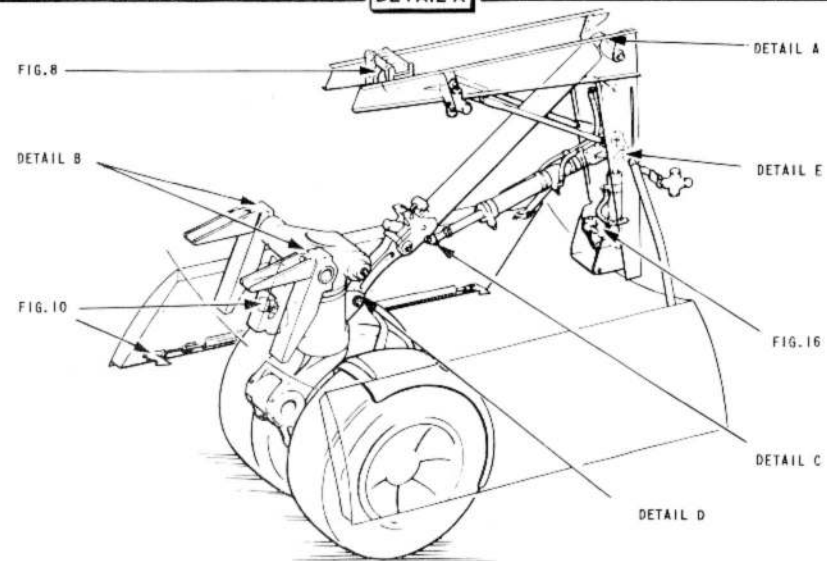
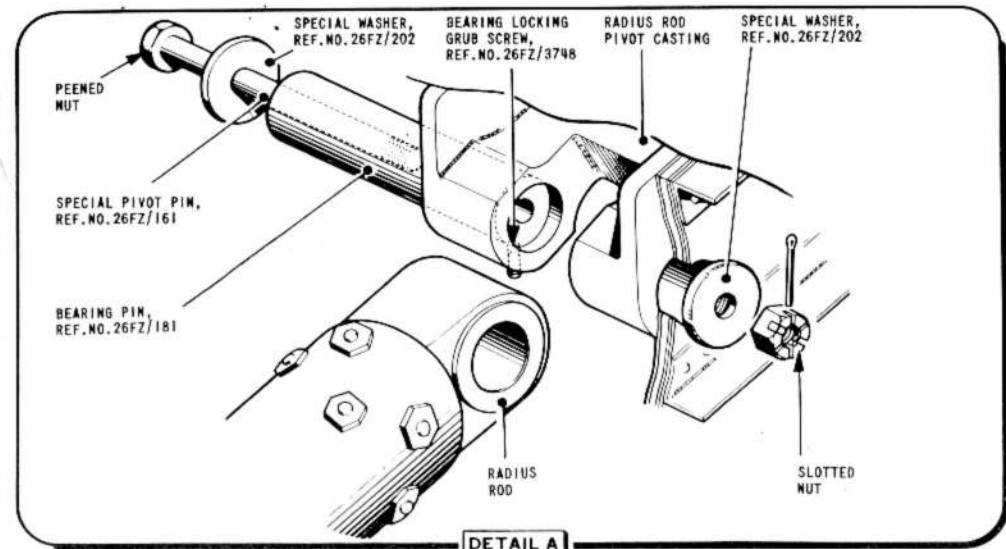


Fig. 14. Undercarriage removal and assembly (1)

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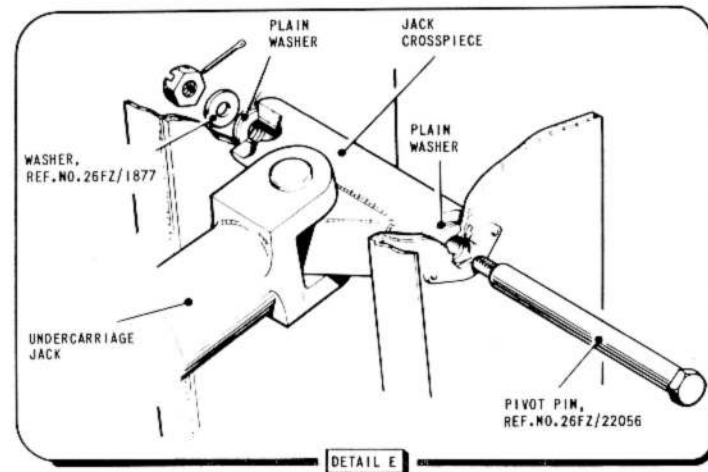
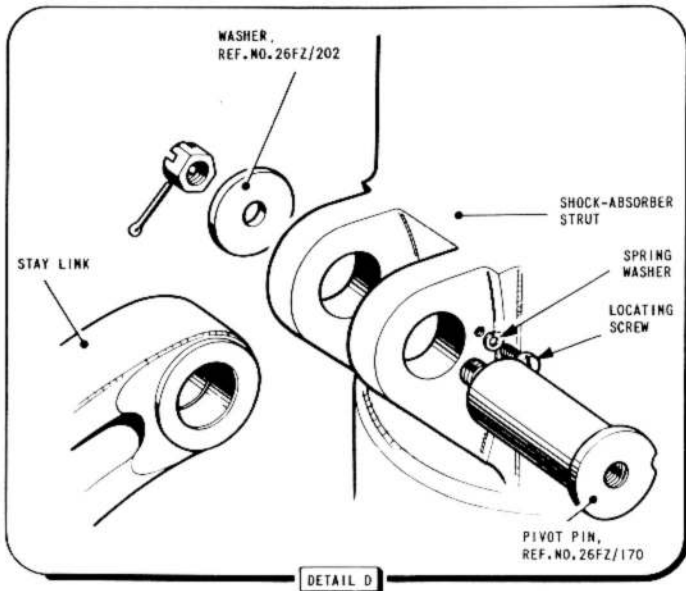
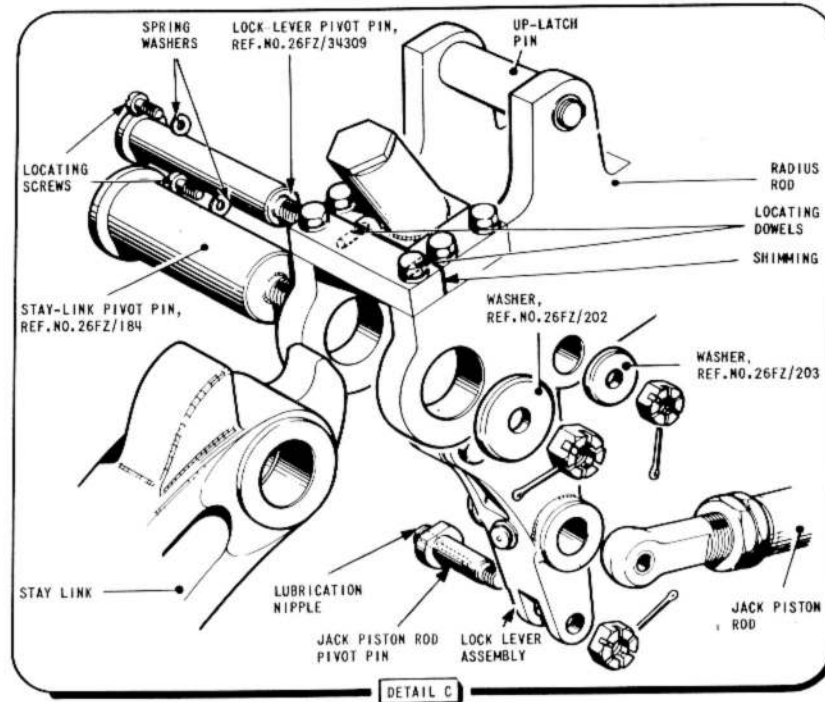
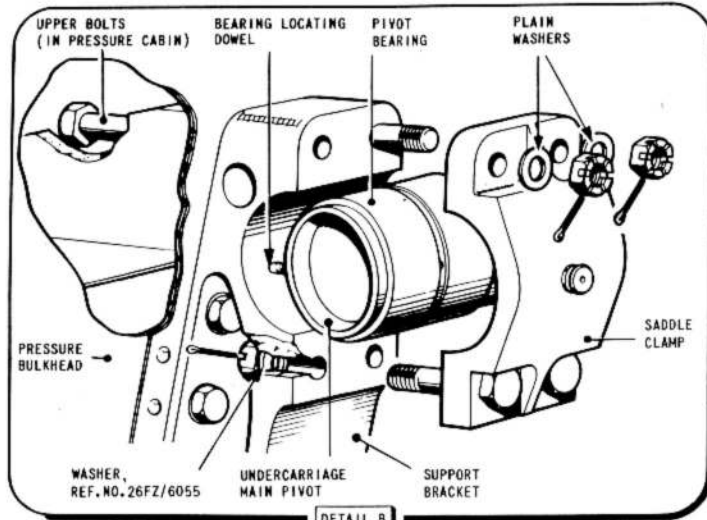


FIG.15. UNDERCARRIAGE REMOVAL AND ASSEMBLY (2)

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and special washer from the radius rod upper pivot pin (fig.14, detail A).

Note...

The head of the pivot pin is a plain nut which is, and must remain, peened.

(14) Slacken the bearing pin retaining grub screw on the starboard shoulder of the radius rod pivot bracket casting (fig.14, detail A) and, taking the weight of the assembly from the pivot, withdraw the pivot bolt, special washer, and bearing pin. Carefully lower and remove the radius rod/stay link assembly.

(15) Support the undercarriage and remove the split pins, slotted nuts and washers from the four bolts attaching each saddle clamp at the undercarriage main pivot (fig.15, detail B).

Note...

The heads of the four upper attachment bolts are accessible from inside the pressure cabin.

(16) Withdraw the lower bolts and remove the saddle clamps. Remove the undercarriage.

Door mechanism

28.

(1) Remove the split-pins, slotted nuts and special bolts from both ends of each door actuating link and remove the links. Tie the doors in the fully open position.

(2) Remove the four 2 B.A. bolts attaching the mud shield to the hook re-

lease lever mechanism box section.

(3) Disconnect and remove the flexible hydraulic pipes from the door jack. Blank off the exposed pipe ends and jack apertures.

(4) Remove the split pin, slotted nut and special bolt attaching the door jack piston-rod to the crosshead.

Note...

It is necessary to remove the undercarriage jack from its aft pivot (para.27) to gain access to the door jack piston-rod attachment bolt.

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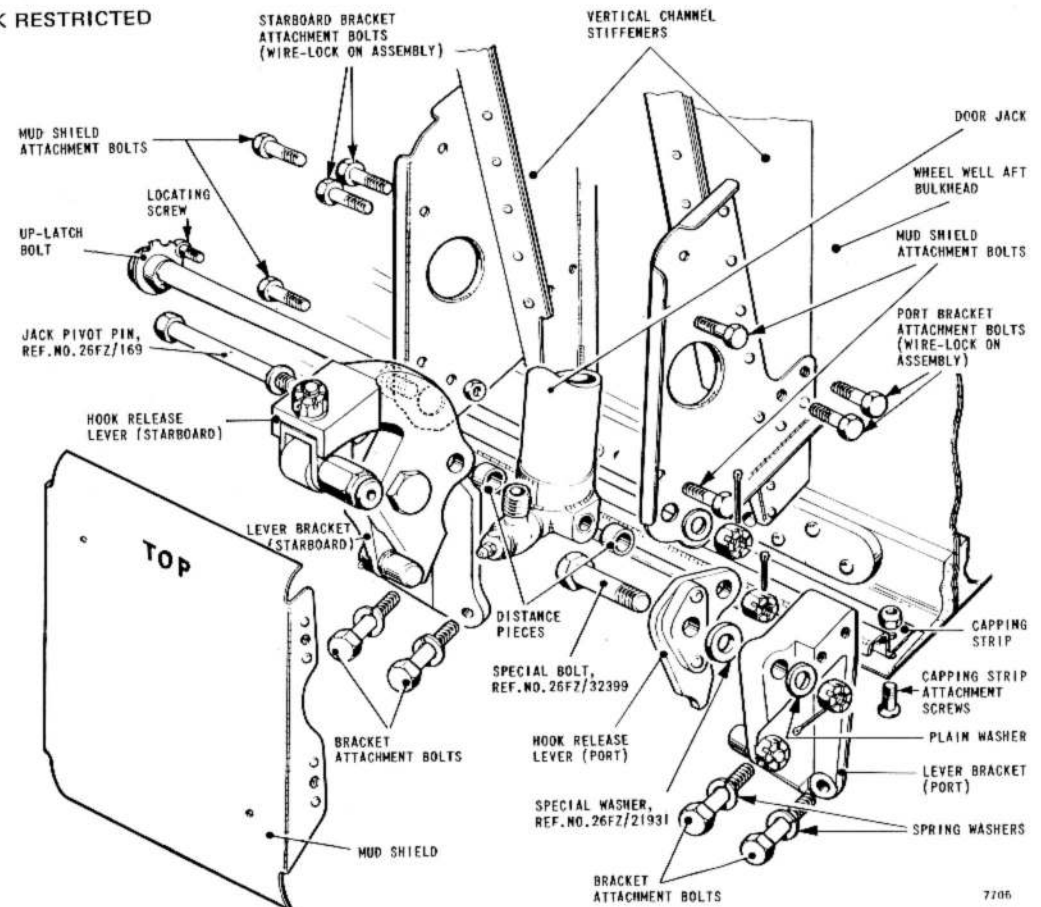


FIG.16. HOOK RELEASE MECHANISM & DOOR JACK REMOVAL

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(5) Remove the countersunk headed screws attaching the capping strip to the fuselage skin on the lower forward face of the wheel well aft bulkhead (fig.16).

(6) Remove the split pin, slotted nut and washer from the up-latch bolt. Remove the bolt, taking note of the position of the scalloped head in relation to the locating screw (fig.16).

(7) Remove the two 1/4 in. bolts and spring washers attaching the bottom of each release lever bracket to the aft bulkhead (fig.16).

(8) Break the wire-locking and remove the two 2 B.A. bolts securing each release lever bracket to the vertical channel stiffeners.

(9) Remove the door jack and release lever mechanism by sliding the complete assembly upwards and out through the top of the vertical channel stiffeners.

Note...

When this operation is made with the undercarriage jack still in situ and disconnected from its aft pivot (para. 27), the jack must be strapped clear from the top of the channel stiffeners.

(10) Disconnect the door jack from the hook release lever mechanism by removing the split pin, slotted nut, pivot bolt, washer and distance pieces (fig.16).

(11) Dismantle the hook release levers

from their brackets by removing the split pin, slotted nut, washer, Part No.EA1.10.1407 and bolt Part No.EA1.10.3219 from each lever (fig.16).

(12) Remove the thirty-eight 2 B.A. bolts, washers and stiffnuts securing the crosshead roller guides to the aft bulkhead, and remove the guides.

(13) Withdraw the jack crosshead from the slots in the vertical channel stiffeners.

Undercarriage and undercarriage doors mechanism assembly (fig.14, 15 and 16)

General

29. Consideration has been given in the following sequence of operations, to the additional work entailed in fitting replacement components. It will be obvious which operations are not necessary when reassembling original items. Instructions for fitting new undercarriage doors are given in A.P.101B-0400-6, Part 1. To reassemble the undercarriage and undercarriage door mechanism:-

Door mechanism

30.

(1) Refit the door jack crosshead between the vertical channel stiffeners on the aft bulkhead, and fit the roller guides over the crosshead rollers using the thirty-eight 2 B.A. bolts, washers and stiffnuts.

(2) Assemble each hook release lever to its bracket using the special bolt and washer, plain washer, slotted nut and split pin (fig.16).

Note...

The washer Part No.EA1.10.1407 fitted between each lever and bracket may be filed on assembly to obtain free movement of the lever. Protective treatment (A.P.119A-0509-1) must be applied to all filed surfaces.

(3) Fit the door jack lower pick-up point to the hook release lever mechanism, using the pivot pin Ref.No.26PZ/169, distance pieces, washer, slotted nut and split pin (fig.16).

(4) Slide the complete jack and release lever mechanism assembly from the top to the bottom of the vertical channel members.

(5) Connect the door jack piston-rod eye-end to the crosshead, using the bolt, slotted nut and split pin.

(6) Bolt the hook release lever brackets to the aft bulkhead using the four 1/4 in. bolts and spring washers (fig.16).

(7) Fit the two 2 B.A. bolts to secure each release lever support bracket to the vertical channel stiffeners (fig.16). Tighten and wire-lock the bolt heads together.

(8) Refit the up-latch bolt, ensuring the scalloped head is returned to its original position. Fit the washer, slotted nut and split pin (fig.16).

(9) Refit the capping strip to the

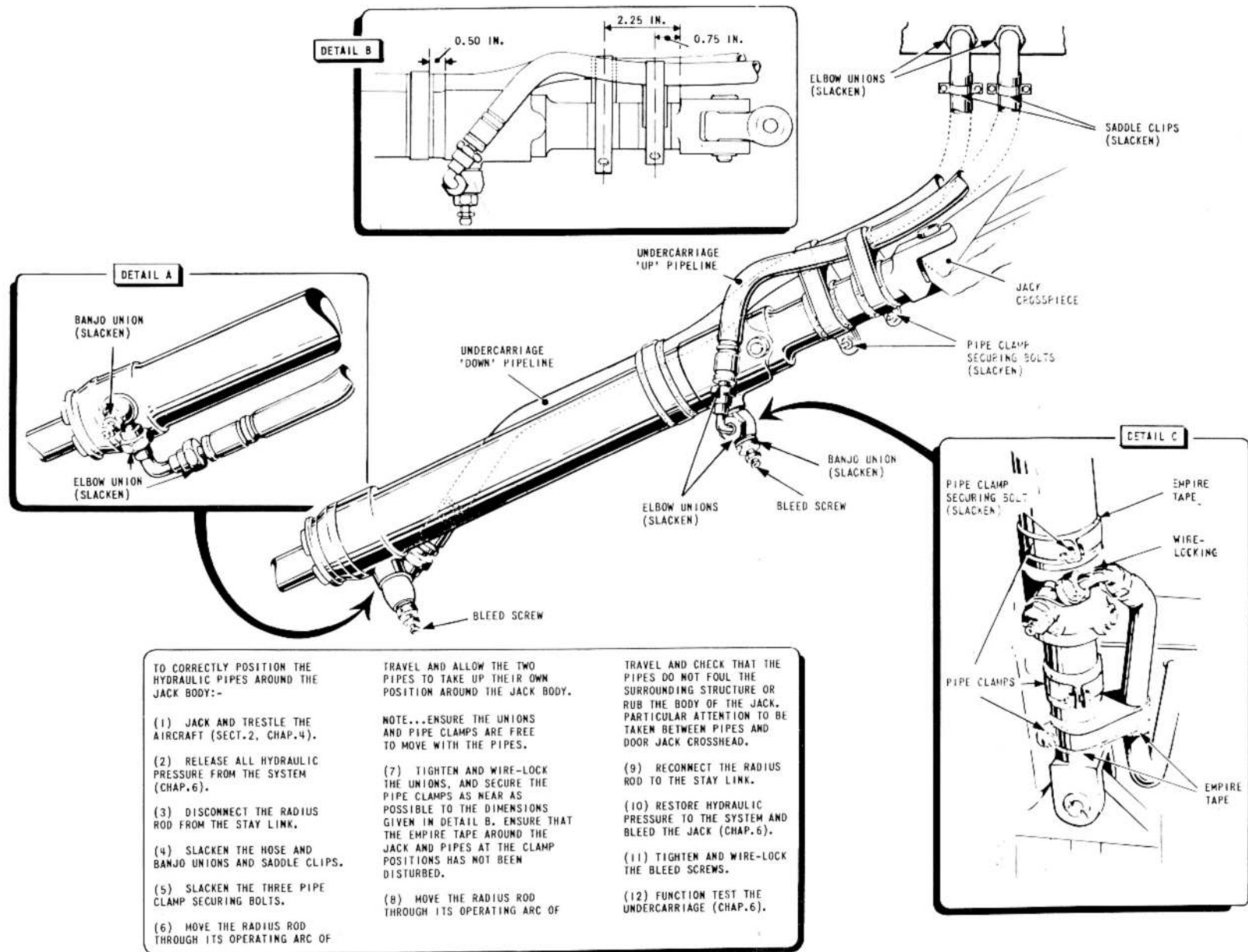


FIG.17. UNDERCARRIAGE JACK HYDRAULIC PIPES CLIPPING

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lower lip of the aft bulkhead using the countersunk screws and stiffnuts (fig. 16).

(10) Reconnect the flexible hydraulic fluid pipes to the door jack. Prime and bleed the door jack hydraulic circuit (Chap.6). Wire-lock the pipe unions.

(11) Refit the mud shield over the hook release lever mechanism box section using the four 2 B.A. screws. Replace the packing washers, if any, in their original positions (para.28 (2)).

Note...

Ensure that hydraulic fluid pipe Part No.OC.101B/10 (fig.1), which runs to the top of the door jack, is positioned in its cleat on the mud shield so as to give the maximum possible clearance between its elbow union and the port wheel tyre during undercarriage retraction.

(12) Reconnect the door-actuating links to the doors using the bolts, slotted nuts and split pins.

Note...

The proceeding operations will, on their completion, necessitate a thorough check of the door-operating and latching mechanism adjustment (para.23).

Undercarriage

31.

(1) For ease of access, remove the door actuating links and tie back the doors.

(2) Assemble the undercarriage to its main pivot support brackets, taking care to ensure that the pivot shaft bush is properly located by its spigot on both the port and starboard saddle clamp faces (fig.15, detail B). Fit the four bolts, washers, slotted nuts and split pins which secure the removable half of each saddle clamp.

Note...

The heads of the four upper saddle clamp bolts are accessible from inside the pressure cabin.

(3) Refit the radius rod to its upper pivot point by inserting the bearing pin. Slide the pivot pin, with a washer, through the bearing pin and secure with another washer and slotted nut and split pin (fig.14, detail A). Tighten the bearing pin locking grub screw.

Note...

The radius rod assembly must not be allowed to fall below its normal operating position or its underside will foul and damage the 'single-coil-shaped' rigid hydraulic pipe situated on the aft bulkhead immediately below the radius rod upper pivot attachment (fig.1).

(4) Reconnect the stay link to the lugs on the undercarriage strut, using the pivot pin and washer, slotted nut and split pin. Refit and tighten the locating grub screw at the head of the pivot pin (fig.15, detail D).

(5) Reconnect the electrical cables to

the two microswitches on the radius rod/stay link knuckle joint. Reclip the cables to the radius rod tube (A.P.101B-0417-1B, Sect.6, Chap.5) and ensure they will not foul when the undercarriage is retracted.

(6) Position the undercarriage jack crosspiece, between the aft bulkhead vertical flanged stiffeners. If flanged bushes are not fitted to the channel stiffeners (para.27) ensure that a washer, Ref.No.28W/9419467 is inserted at each side of the jack pivot, between the jack crosspiece and the channel stiffeners. Insert the pivot pin from the port side, ensuring that its head seats into the locking plate on the port channel stiffener (fig.15, detail E).

(7) Secure the pivot pin using the washer and slotted nut. Measure the gap at each end of the crosspiece; the washers (if fitted) must be pressed against the channel stiffeners. Where the total of the two gaps does not exceed 0.015 in. lubricate the assembly and fit the split pin to the pivot pin slotted nut.

Note...

Should the total gap exceed 0.015 in. standard washers, Ref.No.28W/9419467 and/or locally manufactured washers are to be fitted to equalize the gaps and give a total gap of between 0.005 in. and 0.010 in. Locally manufactured washers are to be made from the appropriate s.w.g. steel sheet Spec. S.520 or S.521. No washer is to be less than 30 s.w.g. (0.012 in).

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(8) Connect the flexible hydraulic fluid pipes to the jack and fit the blocks and clamps to the jack body (fig. 17).

Note...

The hydraulic fluid pipes must be so positioned and secured in their blocks that, during the operation of the jack, they will not foul either the door jack crosshead or any other part of the structure (fig. 17).

(9) Prime and bleed the jack and pipelines (Chap. 6) and fully close the jack, using the aircraft hand pump.

(10) Check, and if necessary adjust, the jack overrides (para. 20).

Note...

When hydraulic pressure is first applied, the door jack will move and trip the undercarriage sequence valve, allowing pressure to be transmitted to the undercarriage jack.

(11) Connect the jack piston-rod to the radius rod lock lever using the pivot bolt, slotted nut and split pin (fig. 15, detail C).

(12) Raise the undercarriage fully and adjust the door jack sequence valve (para. 24).

Note...

When raising the undercarriage door jack with the actuating links disconnected from the doors, an assistant must hold and guide the links to prevent damage to the adjacent hydraulic fluid piping and aircraft structure.

(13) Check, and if necessary adjust, the up-stop pedestals (para. 22).

(14) Ensure that the up-latch hook is engaging the radius rod latch pin. Adjust if necessary (para. 22).

(15) Lower the undercarriage and fit the landing wheels and mudguards.

(16) Fit the starboard door-actuating link (para. 30) and raise the undercarriage. Ensure that the undercarriage and undercarriage door mechanism is operating correctly.

(17) Check, and if necessary adjust, the undercarriage and undercarriage door microswitches (fig. 13).

(18) Fit the port door-actuating link (para. 30) and raise the undercarriage. Check that the doors fit flush with each other and that their leading edges are 0.030 in. 'out-of-wind' (para. 23).

(19) Function-check the operation of the undercarriage (Chap. 6).

Up-latch mechanism

32. The removal and assembly procedure for the up-latch mechanism is given in para. 22.

Chapter 6 HYDRAULIC SYSTEMS

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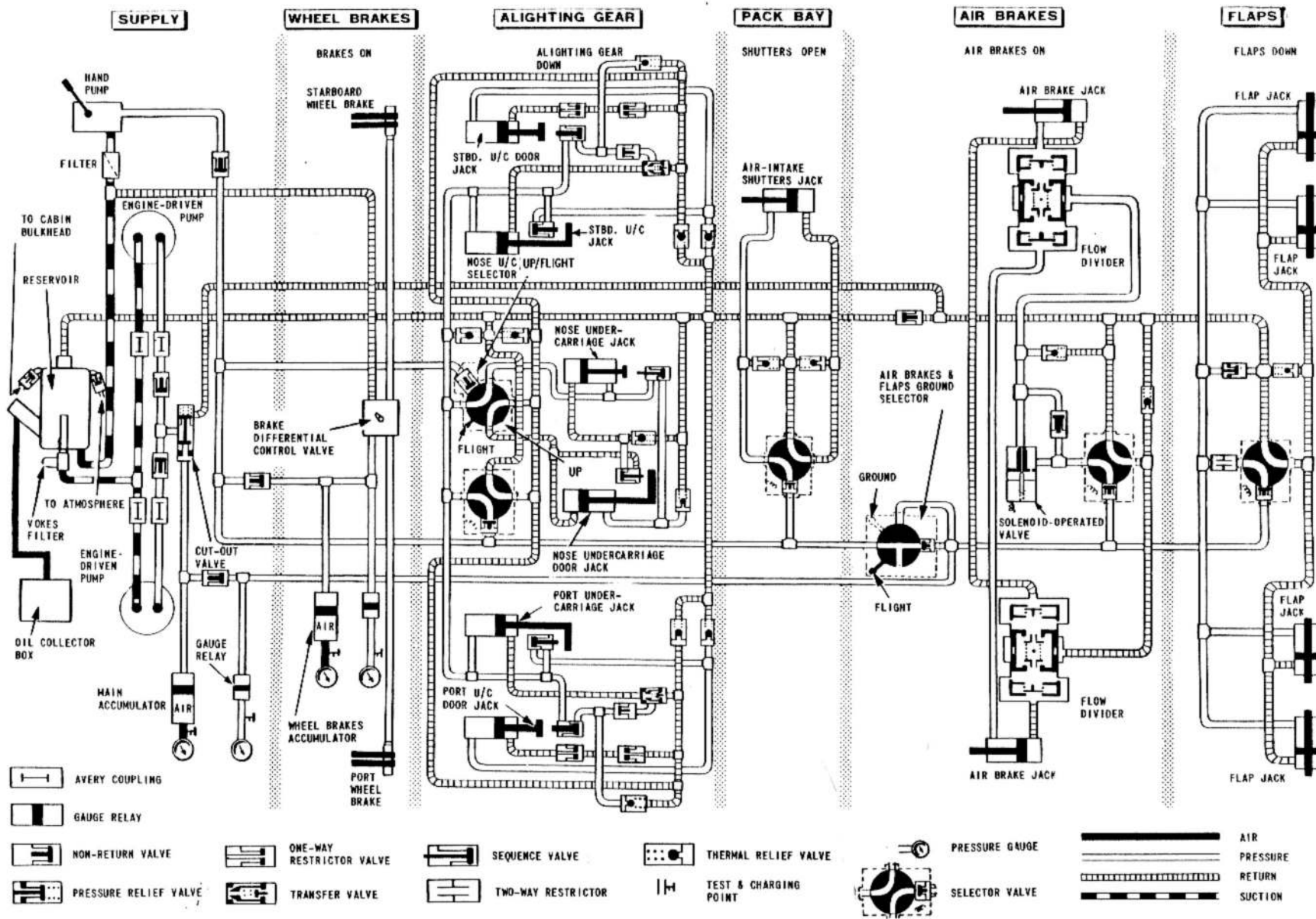
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Introduction

1. This chapter describes and illustrates the hydraulic system, gives details of the servicing operations and recommends methods for the removal and assembly of certain components. The system provides power for the operation of the alighting gear, flaps, air-intake shutters, air brakes and wheel brakes.



1. HYDRAULIC SYSTEM DIAGRAM

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List of major components

2. The major components of the system, together with their Air Publication references, are:-

Component	Description	A. P.	Sect.	Chap.	No. off per A/C
Engine-driven pump	Lockheed Mk.9(37J/266)	1803B	2	2	2
Hand pump	Turner 77-C-1275	105B-0217-1			1
Accumulator	Lockheed, AIR40016	1803B	5	1	2
Brake differential/ control valve	Dunlop, AC61762(27G/3460)	1803S	7	2	1
Brake units:					
Port	Dunlop, AH9597	2337	3	2	1
Starboard	Dunlop, AH9598	2337	3	2	1
Gyp inflation valve	High Pressure Components Ltd. A58	4303Z	4	6	6
Automatic cut-out valve	Lockheed, AIR41158	1803B	10	2	1
Filter, Vokes	27B/1877(30L/1/7915) or 27B/2620(30L/1/22537)	1803P	5	1	1
Hand pump oil filter unit	Dowty, C2254Y	1803D	6	2	1
Flow dividers	British Messier, 8076/52	1803T	13	1	2
Gauge relay	Electro Hydraulics, 7391	1803F	14	1	2
Jacks:					
Air brakes	Dowty 103035001 or 103036001	105B-0986-16C			2
Air-intake shutters	Dowty, 5243	105B-0907-16C			1
Flaps	Dowty, 07016Y.C.O.1	1803D	10	38	4
Main undercarriage	Dowty, 07017Y.C.O.1	1803D	10	36	2
Nose undercarriage	Dowty, 08214Y.C.O.1	1803D	10	37	1
Main and nose undercarriage doors	Dowty, 08246Y.C.O.1	1803D	10	34	3
Non-return valve	U.M.C.704 (27W/8)	1803P	4	2	2
◀ Non-return valve	U.M.C.706/4 (27W/17)	1803P	4	2	6 ▶
Non-return valve (pressurization)	British Messier, 8557	1803T	13	10	1
Non-return valve	Dowty, 5240Y	1803D	9	58	1

continued...

◀ List of major components - continued ▶

Component	Description	A. P.	Sect.	Chap.	No. off per A/C
Pressure-relief valves:					
Flaps	Dowty, C1034Y, Mk.Q	1803D	9	11	1
Reservoir	Dowty, D2568Y,	1803D	9	42	1
Restrictor valves:					
Flaps	Dowty, D657Y	1803D	9	21	1
Main undercarriage doors	Dowty, 03371Y.B.O.1 and Dowty, 06209Y.B.O.1	1803D 1803D	9 9	41 81	2 2
Selector valves:					
Air brakes and flaps	Dowty, 408Y, Mk.BL	1803D	7	13	2
Alighting gear	Dowty, 408Y, Mk.BQ	1803D	7	13	1
Air-intake shutters	Dowty, 408Y, Mk.BR	1803D	7	13	1
Ground/flight selector valves:					
Air brakes and flaps	Dowty, 408Y, Mk.BN	1803D	7	19	1
Up/flight selector valve					
Nose undercarriage	Dowty, 01183Y, Mk.B.O.2	1803D	7	20	1
Sequence valves:					
Main undercarriage, port	Dowty, D401Y, Mk.L	1803D	9	23	1
Main undercarriage, starboard	Dowty, D401Y, Mk.M	1803D	9	23	1
Main undercarriage, door, port	Dowty, D401Y, Mk.K	1803D	9	23	1
Main undercarriage, door, starboard	Dowty, D401Y, Mk.J	1803D	9	23	1
Nose undercarriage	Dowty, C401Y, Mk.G	1803D	9	23	1
Nose undercarriage doors	Dowty, C401Y, Mk.H	1803D	9	23	1
Thermal relief valve	Dowty, C4603Y, Mk.E	105B-0738-16			13
Thermal relief valve	Dowty, C8697Y, Mk.A	105B-0738-16			2
Transfer valve	Dowty, C6790Y, Mk.A	1803D	9	67	2
Solenoid-operated valve (air brakes)	British Messier, 6330	1803T	14	1	1
Pressure gauge	Mk.14 LL (6A/2693)	112G-0400-1			4

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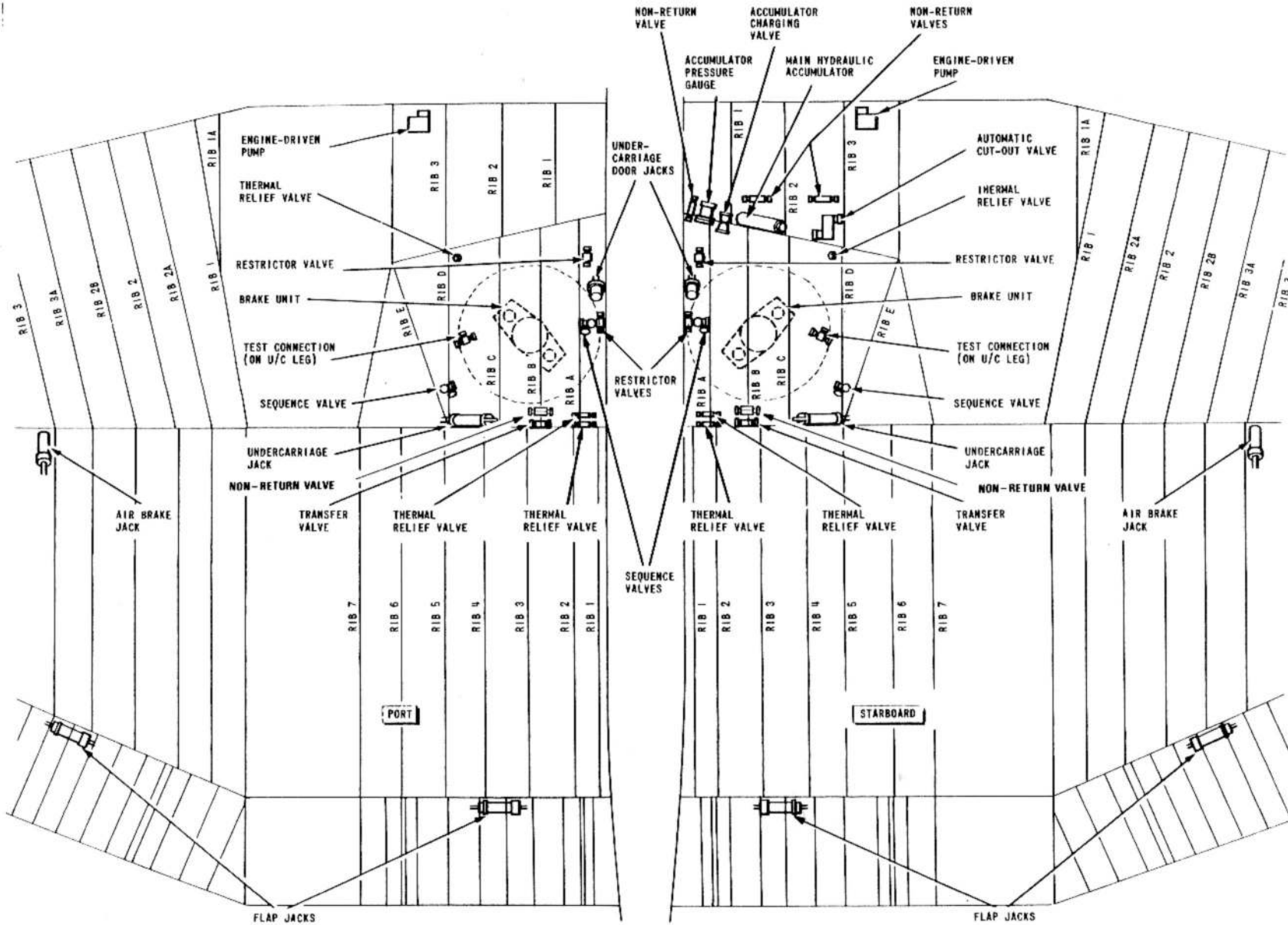


FIG. 3. LOCATION OF HYDRAULIC COMPONENTS IN MAIN PLANES

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DESCRIPTION**Hydraulic fluid reservoir**

3. The reservoir is mounted just to the rear of the pressure bulkhead, against the upper starboard fuselage skin. It is oval in shape and is inclined at an angle of approximately 45 deg. The filler neck is on the side and is accessible through a Dzus-fastened panel in the fuselage skin. The engine-driven pump suction pipeline is taken from a stack-pipe in the bottom of the reservoir, thus providing a reserve of fluid for the hand pump. The suction pipe for the hand pump is taken from a point slightly higher up, although, due to the reservoir being inclined, this is its lowest point. A pipeline from the pressure bulkhead ducts cabin pressure to the reservoir, and a non-return valve in this pipeline maintains a maximum pressure difference of $\frac{1}{2}$ lb/in² between the cabin and reservoir pressures when the cabin pressure system is in operation. A pressure relief valve, situated in a pipeline connecting with the tank above fluid level, blows off at 12 to 17 lb/in², reseating itself when the pressure falls to 8 lb/in²; this blow-off line is led to atmosphere through the bottom of the fuselage.

Power circuit

4. Power is supplied by two continuously running hydraulic pumps, one mounted on each engine accessory gearbox. The pumps draw fluid from the reservoir, through a filter located on the forward face of frame 13 bulkhead, and deliver it under pressure to the four rotary control valves and the brake

differential control valve. A non-return valve is fitted in the pipeline on the pressure side of each pump and the flexible pipes from each pump are fitted with self-sealing couplings. (These couplings may be broken to enable hydraulic servicing trolleys to be connected into the circuit for ground testing purposes.) An automatic cut-out valve, located in the starboard main-plane leading edge, is fitted in the pressure line and connects to the return line, providing an idling circuit and diverting the pump delivery back to the reservoir between operational demands; it is set to cut out when the accumulator pressure reaches $2500 \pm_{100}^0$ lb/in² and to cut in at a minimum pressure of 2000 lb/in². A gauge, mounted on the starboard instrument panel, gives indication of the pressure in the power circuit.

Note...


This pressure gauge must not be used for circuit testing.

Accumulators

5. The main hydraulic accumulator is mounted inboard of rib 1 in the starboard main-plane leading edge, and is connected to the power circuit by a branch pipe; it maintains a reserve of power, prevents hammering of the cut-out, and provides initial power for the movement of the jacks when a service is selected. The charging valve and pressure gauge for the main accumulator are situated on the forward diaphragm of the starboard wheel well. A second hydraulic accumulator, located on the aft face of frame 12 bulkhead, is connected

to the pressure line of the wheel brakes circuit to provide (in conjunction with a non-return valve on the hand-pump side of the accumulator) an independent reserve of power for application of the brakes. The brakes accumulator pressure gauge and charging valve are situated on the nitrogen charging panel assembly (Sect.2, Chap.2).

Relief valves

6. Thermal relief valves, suitably positioned in the circuits, open when, due to temperature variation, pressure in the line of a service increases to 3350 to 3500 lb/in², these valves reseal when the pressure falls to 3100 lb/in² (min). An additional thermal relief valve  is interposed between the sequence valve and the transfer valve of each main undercarriage circuit; to avoid premature pressure relief of the system and to ensure satisfactory functioning of this valve, a brake differential control valve incorporating a pressure relief valve relieving at a pressure of 3500 ± 100 lb/in², is installed in the wheel-brakes system.

Hand-pump circuit

7. The alighting gear, air-intake shutters and wheel brakes can be operated by the hand pump (situated at the starboard side of the pilot's seat), after the appropriate selection has been made. A ground selector and non-return valve in the pressure line normally isolate the air brakes and flaps from the hand-pump circuit, but provision is made for operating these services by the hand pump during ground

servicing operations. The hand pump draws fluid from the reservoir through a filter mounted on the aft face of frame 12 bulkhead and delivers it under pressure to the service selected. In hydraulic failure due to loss of fluid in the system, sufficient fluid is retained in the reservoir (*para.3*) to operate the air-intake shutters and the alighting gear using the hand pump. A non-return valve, fitted between the transfer valve and door jack operated sequence valve of each main undercarriage, prevents the flow of fluid from the down line to the up line. This, eliminates any loss of the reserve fluid via a failed up-line pipe during lowering of the alighting gear. ▶

Alighting-gear circuit

8. Operation of the alighting gear is controlled by two push buttons marked UP and DOWN, which are mounted on the sloping panel on the port side of the instrument flying panel. Provision is made on the UP selector button for an override UP selection; this is accomplished by rotating the knobbed sleeve of the push button either 60 or 90 deg, depending upon the type of switch fitted, and then depressing the push button. Undercarriage DOWN emergency selection is made by pulling the black-and-yellow painted handle protruding above the alighting gear sloping panel (*para.15*). When a push button is depressed, the selector valve, located in the roof of the special equipment pack bay, is operated by an electrical actuator, and fluid is delivered to the jacks operating the alighting gear and alighting-gear doors. Fluid already in the nose undercarriage and door jacks is returned via the selector valve and return line to the reservoir. Fluid in the main undercarriage jack down circuits, is similarly returned to the reservoir, but return flow fluid in the jack up circuits is passed through transfer valves and sequence valves to the down side of the jacks. The transfer valves, therefore, by supplementing the delivery of fluid to the down side of the jacks, assist in reducing the time required to complete the lowering. This transfer is especially effective where an emergency lowering has to be carried out as the extra fluid provided reduces the number of strokes required on the hand pump.

9. If 'out-of-sequence' retraction occurs due to a defective valve, the hydraulic lock so caused can be overcome by the relieving of the thermal relief valve fitted between the sequence valve and the transfer valve (*para.6*), thus ensuring that the undercarriage can still be lowered in an emergency. Incorporated in each transfer valve is a thermal relief valve which will, under abnormal temperature or pressure changes, relieve from the 'up' to the 'down' line. The main undercarriage units are raised and their doors closed

by the retraction of the operating jacks, whilst the nose-wheel unit is raised and its doors closed by the extension of the operating jacks. Sequence valves incorporated in the circuits ensure that the door and wheel-unit circuits operate in their proper sequence, and restrictor valves in these circuits give smooth operation to all movements. An UP/FLIGHT selector (*para.16*) is connected into the nose-wheel circuits to enable the nose-wheel to be retracted for ground servicing.

Flaps circuit

10. The flaps are operated by a two-position selector switch mounted on the alighting gear sloping panel and marked UP and DOWN. A guard on either side of the switch is provided with holes, into which the flap safety pip-pin can be inserted. The switch controls the electrically-actuated selector valve which directs fluid, under pressure, to either end of the double-ended jacks. Fluid displaced by the movement of the jacks is returned, via the selector valve and return line, to the reservoir. To ensure progressively equal movement of both the port and starboard flaps, a two-way restrictor is incorporated in the down line of the circuit.

Air-brakes circuit

11. This circuit is controlled by a selector switch mounted on the top of the control column, the selector valve being operated by an electrical actuator. Fluid under pressure is delivered through the selector valve to the jacks operating the air brakes, and fluid displaced by the movement of the jacks is returned, via the selector valve, to the reservoir. Flow dividers are incorporated in both lines of the circuit to ensure synchronization of the two operating jacks.

12. The three-position air brakes have a solenoid-operated valve located in the OUT pressure line. Two microswitches, mounted on a bracket attached to the body of the starboard jack and operating in conjunction with the selector switch and the solenoid valve, provide a MID position, in addition to the normal IN and OUT positions; these positions are indicated on the selector switch. Movement of the switch from IN to MID operates the selector valve as for OUT and

continued ...

the air brake drag channels are moved outwards until the MID position is reached. At this point, a cam, mounted on the jack piston-rod, operates the microswitch and closes the solenoid valve; at the same time, by operating a relay, the selector valve is reversed and pressure is directed to the piston end of the jack; the solenoid-operated valve, being closed, prevents the flow of fluid from the opposite end, and thus forms a hydraulic lock. Movement of the selector switch from MID to OUT causes the selector valve to be reversed again and the solenoid valve to open, permitting the jack to be fully retracted and the drag channels to travel to their fully OUT position. On selection of MID from OUT the selector valve is reversed, and the jack extends until the MID position is reached; the solenoid valve then closes, preventing the flow of fluid from the jack, thereby retaining the drag channels at the MID position. When IN is selected from MID the solenoid valve opens and permits the flow of fluid from the jack, which extends to the outward limit, fully withdrawing the drag channels. Selection of OUT from IN, or IN from OUT isolates the microswitch circuit and permits a normal flow of fluid through the system.

Wheel-brakes circuit

13. The wheel brakes are applied by movement of a hand lever, mounted on the control column and connected by a Bowden cable to a differential control valve situated beneath the pilot's raised floor-structure. From the control valve, pressure, proportionate to the degree of movement of the brake lever,

is supplied to the brake units. To enable the pressure actuating each brake to be varied when taxiing or towing the aircraft, the control valve is mechanically linked to the rudder pedals. The brake differential control valve reduces the system pressure of 2700 lb/in² to 1500 \pm 150 ₀ lb/in² for braking purposes. A branch pipe from the pressure pipeline is connected, through a gauge relay, to a pressure gauge on the pilot's starboard instrument panel, and to a charging valve mounted on the forward face of frame 1 (*para.18*).

Air-intake shutters circuit

14. A switch with two indicators, one amber (CLOSED) and one green (OPEN), is installed on the starboard wall at the A.E.O.'s station. Selection of the shutter switch to OPEN initiates movement of the selector valve through the medium of an electrical actuator, to direct the hydraulic pressure supply to retract the jack. The jack piston rod is connected to the shutter-operating cable which moves to open the three shutters and contract the cable return spring. Selection to CLOSED causes the jack to extend, thus permitting the return spring to expand and pull the cable to close the shutters.

Mechanical emergency selectors

15. A mechanical emergency selector is provided for operating the alighting-gear circuit in the event of an electrical fault rendering the actuator inoperative (*Chap.11*). The alighting-gear emergency control, situated above the pilot's alighting-gear control panel,

is linked by cable directly to a lever on the selector and, when operated, mechanically moves the selector to the alighting-gear DOWN position, enabling the movement to be completed either by the engine-driven pumps or, alternatively, by the hand pump.

Nose-undercarriage UP/FLIGHT selector

16. A manually-operated UP/FLIGHT selector valve, mounted on the forward face of frame 13 bulkhead on the port side of the battery bay, is positioned in the up and down lines of the nose-undercarriage circuit and has an independent connection to the hand pump delivery pipeline. The selector has two positions, UP and FLIGHT, and is normally wire-locked in the FLIGHT position. In the UP position it enables the nose-undercarriage unit to be retracted, by operation of the hand pump, independently of the main undercarriage.

Air-brakes and Flaps GROUND/FLIGHT selector

17. To enable the air brakes and flaps to be operated by the hand pump during servicing operations, a non-return valve and manual selector, operable only when the aircraft is on the ground, are positioned in the main delivery line, to which the hand pump is connected. The selector, mounted in the roof of the pack bay, has two positions, FLIGHT and GROUND, and is normally wire-locked in the FLIGHT position. In this position the air-brakes and flaps circuits are isolated from the hand pump by a non-return valve; movement of the selector to GROUND opens a line which by-passes

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the non-return valve and permits the air brakes and flaps to be operated by the hand pump after the appropriate selection has been made.

Charging valves

18. Six A.58 Gyp inflation valves are installed in the system for three different purposes; two valves, situated adjacent to each accumulator (*para.5*), are provided for charging the accumulators with compressed air; two more, one on each main-undercarriage leg fairing, are provided as test points for wheel brake pressure testing (*para.31*). A further valve, installed in the main pressure gauge pipeline, is mounted on the forward face of frame 1 in the pressure cabin; this valve is used for priming the pressure gauge and its pipeline (*para.27*). The wheel brakes pressure gauge, also, has a valve in its pipeline to serve a similar purpose; it is situated adjacent to the main gauge valve on frame 1.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

Note...

1. After the removal of any component, or if the system has been drained or partly drained, the engine-driven pumps must be primed (*para.45*) and the complete system bled (*para.24*).

2. During the reassembly of system components, new annealed jointing washers must be fitted to all banjo connections.

General information

19. Scrupulous cleanliness is essential during all servicing operations on hydraulic mechanisms. When dismantling a component, which should be done when possible in a dust-free atmosphere, the parts removed should be laid out in a drip tray.

Note...

Hydraulic fluid has a deleterious effect on paint, rubber, electric cables, etc., and care must be taken to avoid spilling it on such parts.

20. The presence of a foreign body no matter how minute, in a component, might not only shorten the life of the items but could result in a serious failure. Benches tools and test rigs must therefore be kept spotlessly clean, and pipe ends and unions exposed during servicing operations should be blanked off to prevent the entry of dirt. Containers used for holding fluid, or for the reception of drained fluid must be cleaned, then rinsed with a small quantity of fluid which should afterwards be discarded.

Topping up the reservoir

21. The reservoir is to be topped up with the alighting gear selected DOWN, the air-intake shutters OPEN, and with the accumulator hydraulic pressures exhausted. The main accumulator fluid may be exhausted by operating the flaps

selector switch until no movement of the flaps takes place, and the brakes accumulator fluid by repeated operation of the brakes. The reservoir must be topped up to the maximum possible level with fluid OM-15; a drainpipe is provided for fluid spilt through overflowing.

22. Before topping up the reservoir, check the nitrogen pressure in the accumulators; the gauges are situated, one in the starboard undercarriage well (the main) and the other (the brakes) on the nitrogen charging panel (*Sect.2, Chap.2*); the pressure should be as given in the Leading Particulars when the accumulators are exhausted of fluid. If the pressure is high it is an indication that fluid is still contained in the accumulator, and if low the accumulator should be examined and, if it is undamaged and shows no signs of leakage, charged up to the correct pressure. The accumulator charging valves are adjacent to the accumulator pressure gauges.

Draining the reservoir

23. The reservoir is to be drained with the alighting gear and flaps DOWN, the air brakes IN, and the air-intake shutters open.

(1) Connect an external electrical supply (*A.P.101B-0417-1B, Sect.6, Chap.1*).

(2) Exhaust the accumulators (*para.21*).

(3) Remove the hand pump suction line banjo connection at the reservoir, and drain the reservoir at this point.

Note...

Over-tightening of the banjo bolt may

result in stripping the threads. A leak at this point is to be rectified by fitting washers Part No. AGS.1186/C, not by increasing the torque loading on the banjo bolt.

Filling the system

24. To fill the system:-

(1) Jack and trestle the aircraft (Sect. 2, Chap. 4).

(2) Examine the gauze filter in the neck of the reservoir; clean it if necessary. Fill the reservoir to the maximum possible level with fluid OM-15 (para. 22); a drainpipe is provided for fluid spilt through overfilling.

(3) Break the locking wire and move the air brakes and flaps, GROUND/FLIGHT selector (para. 17), to GROUND.

(4) Using the aircraft hand pump, operate each hydraulic service several times in the following order: air brakes, flaps, alighting gear, and air-intake shutters, bleeding air through the respective jack bleed screws and topping up the reservoir until the system is full.

Draining the system

25. The bulk of the fluid can be drained from the system by uncoupling unions or connections at the lowest point of individual pipe runs, depending upon the attitude of the aircraft. Provided that the aircraft is suitably trestled or jacked with wheels clear of the ground, draining may be facilitated by operation of the jacks using the hand pump.

Charging the accumulators

26. The main accumulator charging valve is located in the starboard undercarriage well and the wheel brakes accumulator charging valve on the nitrogen charging panel (Sect. 2, Chap. 2); the accumulator pressure gauges are adjacent to the charging valves. The accumulators are to be inflated to the pressures given in the Leading Particulars, with all hydraulic fluid exhausted (para. 21).

Filling the pressure gauge pipelines

27. The pipelines to the main and wheel brakes pressure gauges are to be filled with OM-15. A Gyp Type A. 58 inflation valve, located on the forward face of frame 1 starboard side, is provided to fill the main pressure gauge line, and a similar inflation valve located adjacent to the main pressure gauge inflation valve, provides the wheel brakes pressure gauge line with the same facility. The following items are required:

Portable hydraulic hand-pump rig with a 0-3500 lb/in² pressure gauge Ref. No. 4G/3029, and a charging valve adapter Ref. No. 4G/6246.

Before commencing the following operations (applicable to both the main and the wheel brakes pressure gauge pipelines), exhaust both accumulators of hydraulic fluid (para. 21).

(1) Remove the locking wire and slacken the priming plug of the gauge relay (located between frames 15 and 16 on the port wall of the pack bay for the main pressure gauge, and between frames 1 and 2 for the wheel-brakes pressure gauge).

(2) Remove the screwed cap of the charging valve at frame 1 and attach the flexible pipe, with adapter from the hand-pump rig, to which the pressure gauge is fitted.

(3) Commence to pump slowly to fill the pipeline and continue until bubble-free oil flows from the gauge relay priming point. Tighten and wire-lock the gauge relay priming plug.

(4) Slacken the pipe union at the aircraft pressure gauge. Operate the pump until clear fluid flows from the pipe union, and tighten the union.

(5) Build up a pressure of 2500 lb/in² and note that the aircraft and rig pressure gauges each register this pressure.

(6) Gradually slacken the pipe union at the aircraft pressure gauge and allow the pressure to fall to zero. Tighten and wire-lock the pipe union.

(7) Remove the adapter from the charging valve, and replace the screwed cap.

Pressure settings and component adjustment

28. Pressure settings of all pressure relief and thermal relief valves are given in Leading Particulars; the adjustment of all the hydraulic components is described in the associated Air Publication Vol. 1 listed in para. 2.

Automatic cut-out valve setting

29. The cut-out valve is to be set to cut out at 2500 $\begin{matrix} +0 \\ -100 \end{matrix}$ lb/in². Final adjustment may be carried out with the

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valve fitted in the aircraft but prior to installation preliminary setting and testing is necessary. Using a static test rig Ref.No.4G/3430 with hydraulic fluid, OM-15, adjust the cut-out and cut-in pressure as follows:-

Preliminary adjustment

(1) Blank off the system connection of the valve and couple the pump connection to the test rig.

(2) Build up pressure gradually with a smooth action of the static rig hand pump and note the pressure at which fluid commences to escape from the reservoir connection; this is the cut-out pressure.

(3) Remove the blank from the system connection to allow the fluid trapped behind the non-return valve to escape, then refit the blank.

(4) Adjust the pressure setting by turning the adjusting screw clockwise to increase, or counter-clockwise to reduce the pressure. Test and adjust alternately until 2500 ± 1.00 lb/in² is obtained

Leakage test

(1) Disconnect the test rig from the pump connection and couple it to the system connection of the valve.

(2) Apply a pressure of 2500 lb/in²; seepage from either pump or reservoir, connections must not exceed 10 c.c. per minute.

(3) Disconnect the coupling from the

system connection and couple to the pump connection.

(4) Apply a pressure of 2200 lb/in²; seepage from the reservoir connection must not exceed 10 c.c. per minute.

(5) Disconnect the coupling from the pump connection and couple to the reservoir connection.

(6) Blank off the pump and system connections and apply a pressure of 2500 lb/in²; there must be no leakage.

Final adjustments in the aircraft

(1) Install the valve and couple to the aircraft system.

(2) Trestle the aircraft (*Sect.2, Chap.4*) and couple a hydraulic servicing trolley fitted with a Lockheed Mk.9 hydraulic pump to the system.

(3) Fill the system (*para.24*) and inflate the accumulators to the correct pressure (*para.26*).

(4) Start the servicing trolley, and check that when the valve cuts out, the main accumulator pressure gauge registers 2500 ± 1.00 lb/in². If the cut-out pressure is incorrect, turn the adjusting screw in the appropriate direction until the correct setting is obtained.

(5) Operate the flaps to discharge the accumulator and cause the valve to cut in. Check that the cut-in pressure is at, or above, the minimum of 2000 lb/in². If not, the valve must be considered unserviceable.

(6) When the correct settings are obtained wire-lock the connections and repeat the test several times to ensure that the settings remain constant.

Pressure test of the system

30. To pressure test the hydraulic system:-

Note...

The reservoirs must be topped-up to the correct level during all bleeding operations.

(1) Jack and trestle the aircraft (*Sect.2, Chap.4*).

(2) Connect an external electrical supply (*A.P.101B-0417-1B, Sect.6, Chap.1*).

(3) Uncouple the delivery pipe at the flap pressure relief valve, adjacent to the flap selector in the roof of the pack bay, and blank off the pipe and the valve.

(4) Charge the main and wheel brakes accumulators (*para.26*).

(5) Move the air brakes and flaps GROUND/FLIGHT selector (*para.17*) to GROUND.

(6) Fill the reservoir with hydraulic fluid OM-15.

(7) Prime and bleed the aircraft hand pump.

(8) With the alighting gear selected ◀ DOWN, the nose undercarriage UP/FLIGHT ▶ selector at FLIGHT, the air-intake

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shutters selected OPEN, the flaps selector at DOWN, the air brakes selector at IN, and the wheel brakes parked, use the aircraft hand pump to fill the system and jacks with fluid until pressure commences to build up.

(9) Check the lengths of the air-intake shutters jack (*Chap. 1*) and the air-brakes and flap jacks (*Chap. 4*), and the alighting-gear jacks and sequence-valve settings (*Chap. 5*).

(10) Top up the reservoir and refit the tank cap.

IMPORTANT

The tank cap must be fitted during all the following tests; on no account must it be removed with the alighting gear UP.

(11) Without altering any system selection (9), bleed all jack pipelines and brake units at the bleed valves or suitable connections on individual jacks.

(12) Build up a preliminary test pressure of 2000 to 2500 lb/in² with the hand pump and check the pressure lines for leaks and security. Hold this pressure for a few minutes, then release.

(13) Remove the nose undercarriage door-actuating links and tie back the doors in the open position.

(14) Select alighting gear UP and, using the hand pump, retract the alighting gear as far as possible leaving the jack bleed valves accessible. Bleed the main and nose undercarriage jacks.

(15) Using the hand pump fully retract the alighting gear, disconnecting the main undercarriage door jacks from the doors as soon as they commence to retract.

(16) Retract the main undercarriage door jacks and extend the nose undercarriage door jack and bleed all three jacks when they have completed the 'doors-closed' stroke.

(17) Select air-intake shutters CLOSED and, using the hand pump, partially extend the jack. Bleed the shutters jack.

(18) Fully extend the jack and ensure that it is not straining the shutters. The method of adjusting the shutters is given in *Chap. 1*.

(19) Select flaps UP and, using the hand pump, partially raise the flaps and bleed the jacks. If the flaps are not assembled to the mechanism, operate the jacks to the end of their stroke before bleeding.

(20) Fully raise the flaps and ensure that they are not under any strain when bearing against the main-plane trailing edges (*Chap. 4*).

(21) Select the air brakes OUT and, using the hand pump, operate the air-brake jacks to the end of their stroke and bleed the jacks.

(22) Test the brake differential control unit by using the hand pump and applying a test pressure of 2900 lb/in². Retain this pressure and check the pressure

drop; it must not exceed 150 lb/in² during the first fifteen minutes. Hold the pressure for a further fifteen minutes and release. The brake differential unit is not to be disturbed.

(23) Lower the flaps, select air brakes IN, open the air-intake shutters, and lower the alighting gear, recoupling the main undercarriage door jacks before the jacks are fully extended (*Chap. 5*). Reconnect the nose undercarriage doors actuating links.

(24) Repeat the pressure test (23).

(25) Move the air brakes and flaps GROUND/FLIGHT selector to FLIGHT, and wire-lock.

(26) Disconnect the external electrical supply.

Functioning tests of the services

31. With the aircraft jacked and trestled (*Sect. 2, Chap. 4*), and using two Mk. 2A, or 2B, or 2C hydraulic servicing trolleys fitted with Lockheed Mk. 9 engine-driven pumps, connected to the Avery couplings in the suction and delivery lines of the aircraft engine-driven pumps, test the functioning of the service as follows:

Note...

The air brakes and flaps GROUND/FLIGHT selector in the roof of the pack bay must be in the FLIGHT position for all power tests.

(1) Connect an external electrical supply (*A.P. 101B-0417-1B, Sect. 6, Chap. 1*).

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(2) Test the power circuit, using both servicing trolleys, and check the operation of the automatic cut-out valve by operating the air-intake shutters, air brakes and flaps. The automatic cut-out valve should cut in at 2000 lb/in² and cut out when the system pressure has built up to 2500 $\begin{smallmatrix} +0 \\ -100 \end{smallmatrix}$ lb/in².

(3) *Alighting gear*

(a) Using both servicing trolleys, retract and lower the alighting gear five times and check that the mechanical down locks, up locks, and door locks, function correctly (Chap.5). The times taken to raise and lower the alighting gear must not exceed fourteen and eight seconds respectively.

(b) Stop the servicing trolley, release all hydraulic pressure and raise the alighting gear using the aircraft hand pump.

(c) Operate the alighting gear emergency control and lower the alighting gear using the aircraft hand pump. Ensure that the nose undercarriage door hooks engage centrally and check the operation of the main doors and shoot-bolts (Chap.5).

IMPORTANT

To prevent oscillation when lowering the alighting gear by the hand pump, station a man at each main alighting gear door with instructions to hold the doors fully open to ensure that the sequence valves controlling the lowering of the alighting gear remain open for returning fluid.

(d) Reset the selector actuator and the emergency control (Chap.11), set the nose undercarriage UP/FLIGHT selector to UP and retract and lower the nose undercarriage with the aircraft hand pump. Set the selector to FLIGHT and wire-lock.

(e) Using the port servicing trolley only, retract and lower the alighting gear once.

(f) Repeat operation (e) using the starboard servicing trolley only.

(g) Using both servicing trolleys retract and lower the alighting gear three times.

(h) Check that the alighting gear indicating lights at both stations function correctly (A.P.101B-0417-1B, Sect.6, Chap.5).

(j) Test each main undercarriage individually as follows:-

(i) Remove the door jack attachment bolt at the piston end (Chap.5).

(ii) Remove the bolt which connects the door check links to the door (Chap.5).

(iii) Using both servicing trolleys retract the main undercarriage ensuring that the door jack piston-rod is clear of surrounding mechanisms and structure.

(iv) Fold the check links back to remove the pressure from the sequence valve plunger.

(v) With the servicing trolleys still running, select alighting gear DOWN and pump vigorously on the aircraft hand pump until the undercarriage is locked down.

(vi) Partially retract the undercarriage and reconnect the door check links and door jack (Chap.5).

(vii) Using both servicing trolleys, retract and lower the alighting gear.

(4) *Air-intake shutters*

(a) Select the air-intake shutters switch to CLOSED, and using the hand pump, fully close the shutters. Check that the amber (CLOSED) coloured indicator lights up.

(b) Operate the PRESS-TO-TEST switch at the OPEN indicator, and check that it lights up.

(c) Select the shutter switch to OPEN, and using the hand pump, fully open the shutters. Check that the amber light goes out, and that the green indicator lights up.

(d) Operate the PRESS-TO-TEST switch at the CLOSED indicator, and check that it lights up.

(e) Select the shutters switch to CLOSED, and using the hand pump, fully close the shutters. Check that the OPEN light goes out and that the CLOSED indicator lights up.

(f) Using both servicing trolleys,

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fully open and close the shutters once only, and finally open them.

(5) *Flaps*

(a) Using both servicing trolleys raise and lower the flaps four times. Check the operation of the flaps position indicator and check the synchronisation of the port and starboard flaps. The time taken to either raise or lower the flaps must be between 15 and 19 seconds.

(b) Using each servicing trolley independently, raise and lower the flaps.

(6) *Air brakes*

(a) Using both servicing trolleys operate the air brakes OUT, MID and IN three times, checking the synchronisation of the port and starboard brakes. The time taken to either extend or retract the air brakes must be between a half and two-and-a-half seconds.

Note . . .

In the MID position the inboard, or outboard drag channel extensions must not differ by more than 0.5 in. between main planes.

(b) Using each servicing trolley independently, operate the air brakes as in operation (a).

(7) *Wheel brakes*

(a) Stop the servicing trolleys and attach adapter Ref.No.4G/6246, with a pressure gauge Ref.No.4G/3028, to the wheel brake test connections in the hydraulic pipes to the brakes.

(b) Start the servicing trolleys and, with wheel brakes off, check that the wheels are free to rotate.

(c) Apply the brakes progressively and, with the rudder bars central, check that at intermediate positions the pressures at each brake do not vary considerably from each other and that when the brakes are fully applied there is a steady pressure of $1500 \pm_{0}^{150}$ lbf/in² at each brake.

Note . . .

For all pressures from zero to 1000 lbf/in² the pressure gauge readings must be within 100 lbf/in² of each other, and for pressures from 1000 lbf/in² to 1500 lbf/in² the readings must be within 150 lbf/in² of each other.

(d) Apply full port rudder and check that the pressure in the port brake remains at $1500 \pm_{0}^{150}$ lbf/in² and the pressure in the starboard brake falls to zero.

(e) Apply full starboard rudder and check that the pressure in the starboard brake returns to $1500 \pm_{0}^{150}$ lbf/in² and the pressure in the port brake falls to zero.
Release the brakes.

(f) Repeat operation (c).

(g) Release the brake lever and check that the pressure at both brakes falls to zero.

(h) Stop the servicing trolleys and remove the adapter and pressure gauge from both wheel brake test connections.

(j) Fully apply the brake lever and operate the parking lever; this should operate easily with one hand.

(8) *Air brakes and flaps GROUND/FLIGHT selector*

(a) Place the selector in the GROUND position and ensure that all hydraulic services can be operated by the aircraft hand pump.

(b) Move the selector back to FLIGHT and check that the air brakes and flaps cannot be operated by the hand pump. Wire-lock the selector valve at FLIGHT.

(9) *Nose undercarriage UP/FLIGHT selector*

(a) Place the selector in the UP position and ensure only the nose wheel retracts when the hand pump is operated.

(b) Move the selector back to FLIGHT and check that both the nose and main undercarriage retracts when the hand pump is operated. Wire the selector valve at FLIGHT.

Procedure after functioning tests

32. After the functioning tests are satisfactorily completed the following operations must be carried out:-

- (1) Disconnect the external electrical supply.
- (2) Disconnect the servicing trolleys and connect the aircraft engine-driven pumps at the Avery couplings.
- (3) Bleed the pumps and top-up the reservoir as instructed in para.21.
- (4) Reseal the emergency release cables as instructed in Chap.8.

(5) Ensure that the air brakes and flaps, and the nose undercarriage, ground selectors are wire-locked in the FLIGHT position with new wire.

(6) Relock and seal the undercarriage emergency release handle as instructed in Chap.11.

Faults and remedies

33. The more common hydraulic faults and their remedies are listed in the following Table; faults in individual components are covered in the appropriate A.P.1803, Vol.1.

Fault	Possible Cause	Remedy
(1) Engine-driven pump and hand pump fail to operate the system	No fluid in the system Leakage in the system	Refill the system Correct the leak and refill the system Note . . . <i>There is no need to change the engine-driven pump unless it has been running in a dry condition for more than thirty minutes.</i>
(2) Engine-driven pump drive shears	Pump seized Excessive pressure due to foreign matter in system Hammering of the automatic cut-out	Change the engine-driven pump (Lockheed Mk.9 (37J/266)) Drain the system and replenish with clean fluid Renew the automatic cut-out (Lockheed AIR.41158)
(3) All services inoperative by engine-driven pumps but services can be operated by the hand pump	Engine-driven pump drives sheared Foreign matter in the filter By-pass valve in the automatic cut-out leaking	Refer to (2) Remove the filter and clean it Renew the automatic cut-out (refer to (2))
(4) Spongy action on hand pump	Air in particular service Faulty non-return valves	Bleed the affected service and test Renew the affected non-return valves (U.M.C.704)
(5) All services inoperative by hand pump	Hand pump worn or damaged	Renew the hand pump (Turner, 77C/1275)
(6) Flaps droop, or spring back from the lowered position	Jack piston-rod glands leaking Non-return valve in rotary control valve leaking Air in system	Renew the jack (Dowty, 07016Y.C.0.2) Renew the rotary control valve (Dowty, 408Y, Mk.BL) Bleed the system and test

continued . . .

Fault	Possible Cause	Remedy
(7) Flaps return to original position after moving	Jack piston-rod glands leaking Leaking rotary control valve Leaking thermal relief valve	Renew the jack (refer to (6)) Renew the rotary control valve (refer to (6)) Renew the thermal relief valve (Dowty, C4603Y, Mk.E)
(8) No movement of flaps upon selection, accumulator pressure correct	Actuator fuse blown	Renew relevant fuse (A.P.101B-0417-1B, Sect.6, Chap.1)
(9) Flaps on one side move in advance of those on the other side	Foreign matter in restrictor valve and pressure relief valve Air in system	Remove the restrictor valve and pressure relief valve, and clean them Bleed the system and test
(10) No movement of air-intake shutters upon selection, with accumulator pressure correct	Actuator fuse blown	Renew relevant fuse (A.P.101B-0417-1B, Sect.6, Chap.1)
(11) Alighting gear doors droop	Door jack piston-rod glands leaking Non-return valve in rotary control valve leaking Air in system Incorrect setting of door jack sequence valves	Renew the affected jack (Dowty, 08246Y, C.O.2) Renew the rotary control valve (Dowty, 408Y, Mk.BQ) Bleed the system and test Reset affected sequence valve
(12) No movement of alighting gear upon selection, with accumulator pressure correct	Actuator fuse blown	Renew relevant fuse (A.P.101B-0417-1B, Sect.6, Chap.1)
(13) Wheel brakes inoperative, with accumulator pressure correct	Broken Bowden cable Slack Bowden cable	Renew the Bowden cable Release the cable and adjust

continued...

RESTRICTED

Fault	Possible Cause	Remedy
(14) Wheel brakes remain on after brake lever is released	Tight Bowden cable	Release the Bowden cable and adjust
	Frayed Bowden cable	Renew the Bowden cable
(15) Air brakes inoperative upon selection, with accumulator pressure correct	Actuator fuse blown	Renew relevant fuse (A.P.101B-0417-1B, Sect.6, Chap.1)
(16) Air brake drag channels protrude from main-plane surfaces	Jack piston-rod glands leaking	Renew the jack (British Messier, 5232)
	Non-return valve in rotary control valve leaking	Renew the rotary control valve (Dowty, 408Y, Mk.BL)
	Air in system	Bleed the system and test
(17) Hammering of the automatic cut-out	Air in system	Bleed the system and test
	Leaking non-return valve	Renew the non-return valve or automatic cut-out
	Broken secondary spring	Renew the automatic cut-out (refer to (2))
	Leaking rotary control valve	Renew the affected rotary control valve
(18) Slow movement of services	Restriction in pressure line	Flush the pressure line - renew if damaged
	Insufficient air pressure in the appropriate accumulator due to leakage at inflation point	Stop the leak, re-inflate and test
(19) Sluggish movement of a particular service with correct accumulator pressure	Air in system	Bleed the system and test

◀ Note...

Fault (19) may only be apparent in flight or with one engine at idling rev/min, and not when using the servicing trolleys. ▶

RESTRICTED

101B-0417-1A/29/462705/250/1-68/BAC/1307

REMOVAL AND ASSEMBLY**General information**

34. Methods of removing certain items from the system are given in the following paragraphs. Generally, the assembly sequence is the reverse of removal, but where there are special reassembly features they are specifically mentioned.

Note...

1. After removal of any component, or if the system has been drained or partly drained, the engine-driven pumps must be primed (para.45) and the complete system bled (para.24).

2. When reassembling hydraulic pipes Part No.EA3.73.799 and EA3.73.803 to the transfer valve in the port wheel-bay, ensure that they are not crossed. The two pipes should run parallel throughout their length.

3. To prevent hydraulic fluid leakage, new annealed jointing washers must be fitted to all banjo connections during reassembly.

Reservoir

35. To remove the reservoir:

- (1) Remove the equipment bay hatch (Sect.2, Chap.4).
- (2) Drain the reservoir (para.23).
- (3) Disconnect all the remaining pipes

from the reservoir, and blank off all exposed pipe ends and apertures.

(4) Remove the locking wire from the trunnion tension rods and unscrew the tension rods. This operation will release the straps retaining the reservoir in position. Remove the reservoir.

Note...

1. When assembling the reservoir, it is important that pieces of hard felt, 3/4 in. x 1/8 in. x 26 in. long, are attached to the reservoir with rubber-resin cement at the retaining strap position.

2. Care must be taken not to overtighten the hand pump suction pipe banjo bolt when reassembling. Leakage at this point should be rectified by fitting washers AGS.1186/C, not by increasing the torque loading on the banjo bolt.

Main accumulator

36. To remove the main accumulator:

- (1) Exhaust all hydraulic pressure from the system (para.21).
- (2) Remove the inboard access panel from the upper surface of the starboard main-plane leading edge (Sect.2, Chap.4).
- (3) Release the nitrogen pressure by depressing the Schrader unit in the charging valve.
- (4) Disconnect and blank off the nitrogen charging pipeline and the hydraulic pipeline at the accumulator.

(5) Remove the bolts on the two retaining straps and remove the accumulator.

Note...

When assembling the accumulator it is important that pieces of hard felt, 3/4 in. x 3/8 in. x 10 in. long, are attached to the accumulator with rubber-resin cement at the retaining strap positions.

Wheel-brakes accumulator

37. Removal and assembly operations for this accumulator are the same as for the main accumulator (para.36) except that it is removed through the battery compartment door on the port side of the fuselage.

Automatic cut-out valve

38. To remove the automatic cut-out valve:

- (1) Exhaust the system of hydraulic pressure (para.21).
- (2) Remove the inboard access panel from the upper surface of the starboard main-plane leading edge (Sect.2, Chap.4).
- (3) Disconnect and blank off the pressure pipelines and the return to reservoir pipeline.
- (4) Remove the three retaining bolts and remove the cut-out valve.

Filter

39. To remove the filter:

- (1) Exhaust the system of hydraulic pressure (para.21).

- (2) Drain the reservoir (para.23).
- (3) Disconnect and blank off the inlet and outlet pipes.
- (4) Remove the two retaining bolts attaching the filter to the channel-section on the forward face of frame 13 bulkhead.
- (5) Lift the filter out of the retaining ring and remove the filter.

Hand pump

40. To remove the hand pump:

- (1) Exhaust the system of hydraulic pressure (para.21).
- (2) Disconnect and blank off the pressure and suction pipes.
- (3) Remove the three attachment bolts in the side of the pump and remove the pump.

Brake differential control valve

Removal

41. To remove the brake differential control valve:

- (1) Exhaust the system of hydraulic pressure (para.21).
- (2) Drain the system (para.25).
- (3) Remove the access panels from the cabin floor.
- (4) Disconnect the four pipelines at the control unit.
- (5) Disconnect the Bowden cable.
- (6) Disconnect the operating lever from the rudder lever.
- (7) Remove the bolts securing the control unit to the cabin floor, and remove the unit.

CAUTION

Prior to reassembly of the Bowden cable to the control valve, check the cable for damage to the strands, and for kinking. If either are evident the cable must be replaced.

Assembly

42.



- (1) Bolt the control valve to the cabin floor, and connect the four pipelines and the Bowden cable to their respective points on the control valve.

- (2) With the rudder bar central, connect the operating rod to the control valve and adjust the rod until the pointer on the control valve is central.
- (3) Fit Turner inflation adapters and gauges to the connections in the hydraulic pipes to the brakes (para.31(7)).
- (4) Ensure that the main hydraulic pressure is 2500 lbf in².
- (5) With the aircraft jacked and trestled (Sect.2, Chap.4), and with the rudder bar central, apply the hand-brake lever and adjust the Bowden cable to give a brake pressure of 1500_{-0}^{+150} lbf in² on the Turner gauges. Release the brakes and ensure that the pressure falls to zero and that the wheels are free to turn.
- (6) Apply full port rudder and check the pressures registered on the Turner gauges: they should be:

Port — 150_{-0}^{+150} lbf in²

Starboard — Zero, with the wheel free to turn

- (7) Apply full starboard rudder and repeat the check in operation (6); the pressures should be:

Starboard — 150_{-0}^{+150} lbf in²

Port — Zero, with the wheel free to turn.

- (8) Check the pressures at various brake lever settings with the rudder bar central. For partly applied brakes at pressures up to 1000 lbf in², there should not be more than 100 lbf in² difference between port and starboard gauge readings. For partly applied brakes at pressures exceeding 1000 lbf in², there should not be more than 150 lbf in² difference between gauge readings.

Note . . .

The brake lever must not be snatched on, as high and incorrect readings may result.

- (9) Remove the Turner inflation adapters and gauges.

Note . . .

Should any fluctuation in the pressures occur at the Turner gauges it is an indication that there is a leak past the differential control valve and the valve is unserviceable.

Engine-driven pump*Removal***43.**

(1) Exhaust the system of hydraulic pressure (*para.21*).

(2) Remove the appropriate access panels (*Sect.2, Chap.4*).

(3) Drain the hydraulic fluid from the pump.

(4) Disconnect and blank off the hydraulic pipes to the pump, and blank off the pump apertures.

(5) Disconnect the pump drainpipe.

(6) Remove the six nuts and spring washers securing the pump to the accessory gearbox, and remove the pump.

(7) Remove the driving quill from the gearbox driveshaft, attach it to the blanking cover, and blank off the gearbox aperture.

Assembly

44. To assemble the pump to the accessory gearbox:

(1) Remove the blanking cover from the gearbox aperture, and retain the gasket.

(2) Lightly smear the pump driving quill with grease XG-277 and insert into the gearbox driveshaft.

Note...

Driving quills are supplied with the accessories gearbox.

(3) Fit the gasket to the pump seating flange on the gearbox.

(4) Prime the pump with hydraulic fluid OM-15.

(5) Offer up the pump to the gearbox, line up the splines and fit the pump over the securing studs on the gearbox flange, ensuring that the bleed screw is at the top of the pump.

(6) Fit and tighten the six nuts and spring washers.

(7) Remove the blanks from the hydraulic pipes and pump apertures, and fit the pipes and apertures.

(8) Connect the drainpipe to the pump, and wire-lock the union.

(9) Bleed the pump (*para.45*).

*Priming and bleeding***45.**

(1) Top up the reservoir with hydraulic fluid OM-15.

(2) Slacken the bleed screw on the pump.

(3) Build up a pressure of 1 to 2 lb/in² in the reservoir.

Note...

To pressurize the reservoir, a cap of local manufacture incorporating a Schrader valve and 0-5 lb/in² pressure gauge, may be used. Pressure should be built up slowly to 1 or 2 lb/in².

(4) Allow fluid to flow from the bleed vent until it flows freely and free from air.

(5) Tighten and wire-lock the bleed screw.

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A detailed list of contents will be found at the beginning of each chapter.

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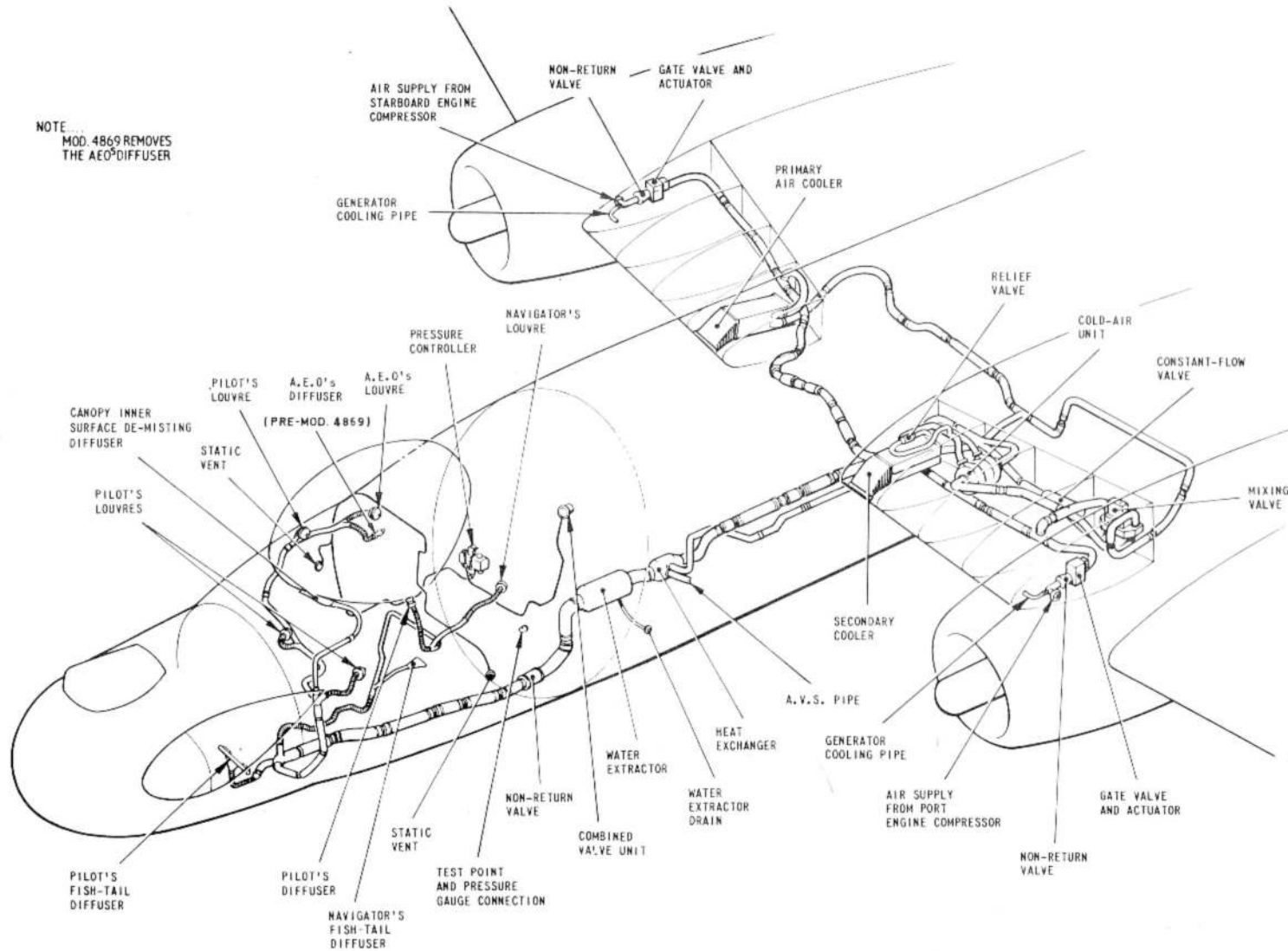


FIG. 1. AIR CONDITIONING SYSTEM

◀ MOD. 4869 INCORPORATED ▶

Introduction

1. This chapter describes and illustrates the method by which the cabin is pressurized and air conditioned; it gives details of servicing operations and recommends methods for removal and assembly of certain items of equipment in the system. Details of the heating and air conditioning electrical circuits are given in A.P.101B-0417-1B, Sect.6, Chap.6.

DESCRIPTION**General information**

2. Air for pressurizing and conditioning the cabin is tapped from the compressor stages of both engines. The cabin pressure is controlled by an automatically-operated relief valve (combined-valve unit) mounted on the pressure bulkhead, and the temperature of the circulating air is controlled by an electrically-actuated mixer valve which is governed by a switch at the pilot's station. The cabin air pressure control operates only at altitudes above 10,000 ft.; below this altitude the atmospheric pressure is sufficient for normal comfort.

Hot-air supply

3. Hot air is tapped from both engine compressors and passed through electrically-actuated gate valves into a main delivery duct which runs laterally through the main planes and fuselage. In the port inner wing equipment compartment a branch pipe is taken from the main duct to the hot-air side of the mixing valve, and a similar branch pipe in the starboard wing is fed into

the inlet side of the primary cooler. Test connections are provided at each end of the main duct immediately downstream of the gate valves.

Cabin temperature control

4. The temperature of the delivery to the cabin is governed by a mixing valve, electrically controlled by the cabin air switch mounted on the pilot's miscellaneous instrument panel. By appropriate operation of this switch air is delivered hot, cooled, or cold. Movement of the switch to HOT directs hot air from the engine compressors through the mixing valve along the main supply duct to the cabin, the air passing through a constant-flow valve, water extractor and non-return valve. By moving the switch to COLD the hot air from the engine compressors is directed through the primary cooler in the starboard main-plane leading edge to the mixing valve in the port main-plane leading edge, the cold side of which allows the partly-cooled air to pass to the compressor side of the cold-air unit. Upon leaving the compressor side of the unit the air passes through the secondary cooler to the turbine stage of the unit and then, very cold, through the main supply duct to the cabin. A relief valve, with outlet to the secondary-cooler outlet duct, upon which it is mounted, is incorporated in the line to prevent build-up of pressure in the cold-air unit. The cabin heat control switch can be operated to give any desired temperature; it has a centre off position and, when in use, should be held to the HOT or COLD position, whichever is desired, until

the required temperature is obtained and then returned to off. The position of the mixing valve is registered on the CABIN AIR indicator mounted below the control switch on the miscellaneous instrument panel.

Note...

1. *No air will be supplied to the cabin unless the gate-valve switches are set to ON.*
2. *In the event of a fault developing in the supply from an engine, or if an engine fails or is shut off, the gate-valve switch of the engine should be set to OFF.*

5. From the constant-flow valve in the port main-plane leading edge, the main cabin supply duct passes into the fuselage and then forward to the water extractor at frame 11, and through the non-return valve at the pressure bulkhead. In the pressure cabin, the duct branches into three smaller ducts at frame 3 to supply the pilot's, navigator's and A.E.O.'s stations with the conditioned air through louvres and diffusers (*para.6 and 7*). In addition to supplying conditioned air to selected areas, the combined mass of the air from the louvres and the diffusers also maintains the cabin pressure at a predetermined level, at altitudes above 10,000 ft.

Cabin air distribution**Louvres**

6. Conditioned air is delivered to various parts of the cabin through pipes branching from the main cabin

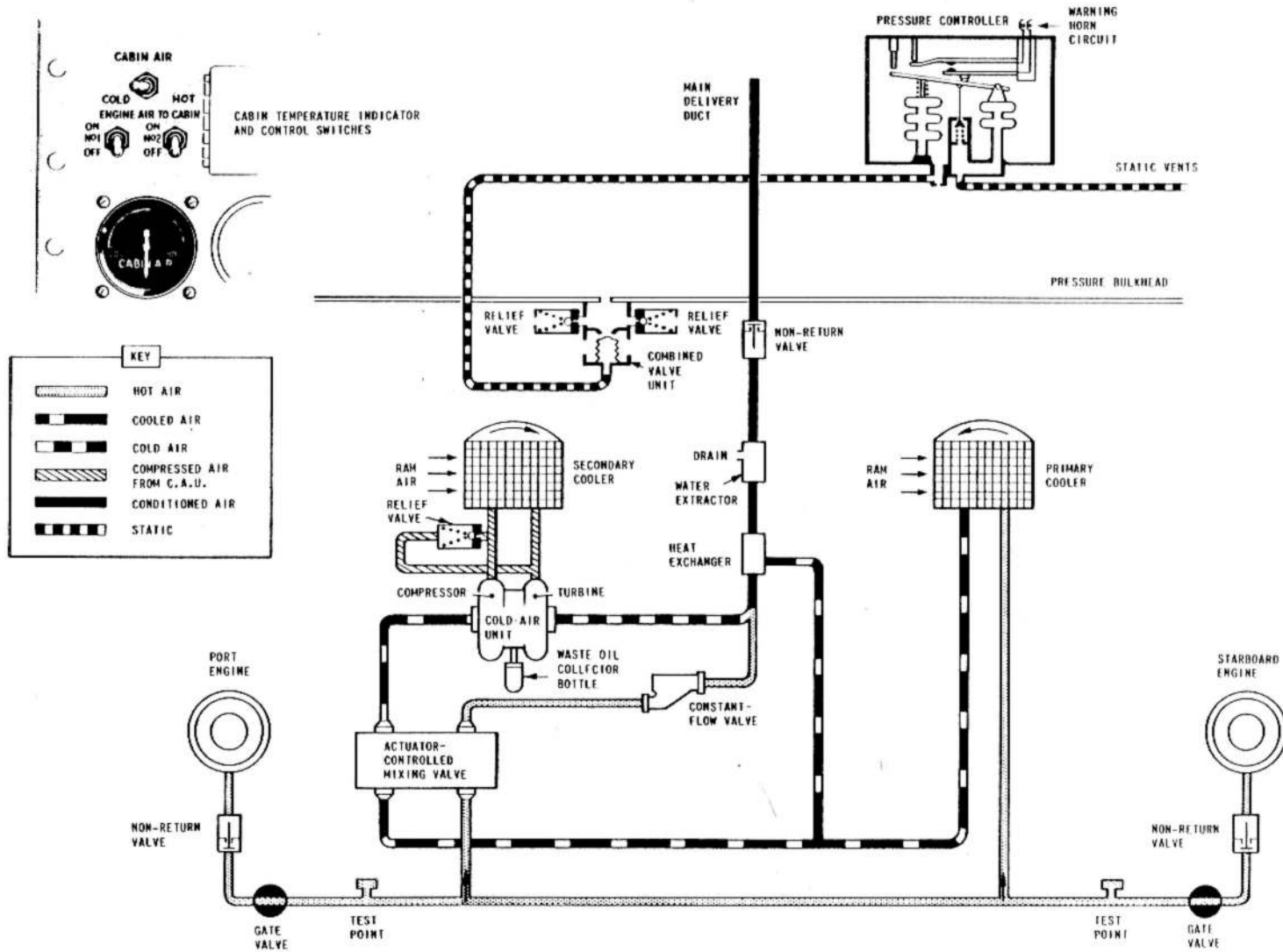


FIG. 2. AIR CONDITIONING SYSTEM—THEORETICAL

◀ A.V.S. SUPPLY PIPE DELETED ▶

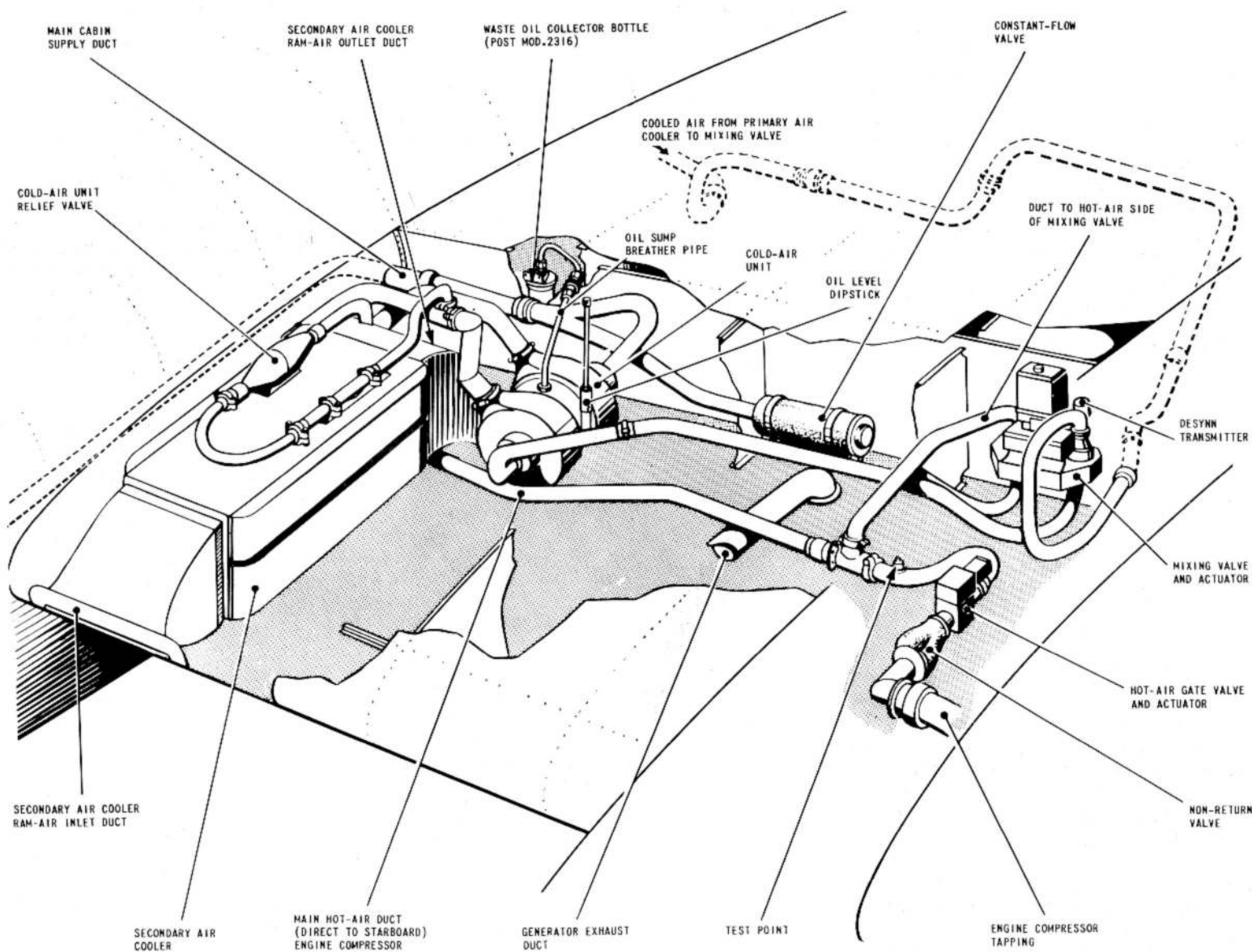


FIG. 3. AIR CONDITIONING SYSTEM - PORT INNER-WING, LEADING EDGE

supply duct, some of which terminate in louvres controllable by the crew. The pilot's station has three louvres located one on the rudder pedal guard, one on the alighting-gear control panel and one on the coaming tube above the entrance door. Another louvre on the inboard side of the alighting-gear sloping panel controls the pilot's supply of cold air from outside the aircraft (para. 8). The navigator's and A.E.O.'s stations have one louvre each; the navigator's louvre is mounted on the port side of the cabin above the chart table, and the A.E.O.'s louvre is mounted on a bracket attached to frame 6.

◀ Note...

Louvre attachment bolts must be fitted with their heads outboard to prevent possible fouling of the canopy detonator cable at frame 4 on the starboard side of the cabin.

Diffusers

7. The pilot's and navigator's stations have fish-tail shaped diffusers located forward of the respective crew member's feet, and controllable diffusers attached to the coaming tube, to port of the pilot, and to the coaming cross tube (A.E.O.'s station). The control on the latter two diffusers changes the flow of air from a diffused flow to a jet by rotation of the diffuser top. There is no provision for the diffusers to be shut off. Mod. 4869 removes the diffuser at the A.E.O.'s station.

Pilot's cold-air supply (fig. 4)

8. A supply of cold air to the pilot is provided by a small air-scoop, located on the front fuselage skin immediately forward of the canopy, which directs ram air along a duct to a louvre mounted on the inboard side of the alighting-

gear sloping panel. A simple non-return valve in the duct prevents cabin pressurizing air blowing back through the system, and any moisture which may collect in the duct is drained through a small pipe leading to a drain hole in the fuselage skin. The supply can be

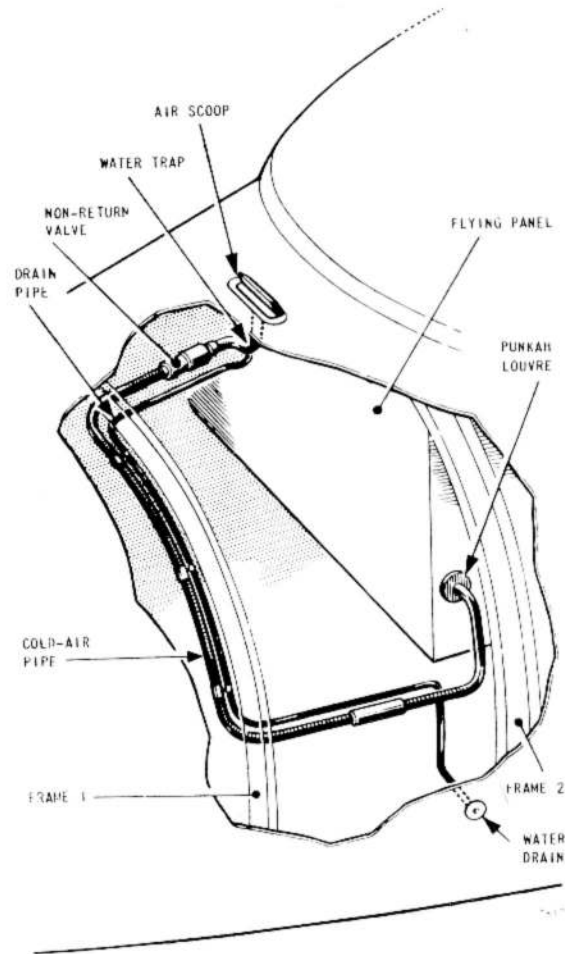


Fig. 4. Pilot's cold-air supply

controlled by the pilot by movement of the louvre.

Hot-air (gate) valves

9. An electrically-actuated gate-valve is mounted on the inboard face of each engine rib in the hot air delivery duct from the engine compressors. Operation of the gate valve actuator to ON lifts a carbon slide clear of the air flow and allows air to pass into the system. The gate-valves can be operated independently by two toggle switches mounted on the pilot's miscellaneous instrument panel; their purpose is to shut off air from either engine should a fault occur or if an engine fails.

Air coolers

10. Two air coolers, a primary and secondary, are installed in the leading edges of the starboard and port main planes, respectively, between the fuselage and rib 1. In flight, ram air enters through the intakes in the main-plane leading edges, cools the system air passing through the radiator-type units, and exhausts to atmosphere beneath the main planes.

Mixing valve (fig. 5)

11. The mixing valve, installed in the port main-plane leading edge equipment compartment, consists of a light-alloy body housing two carbon slide valves, each with an inlet and outlet port. The valves are operated simultaneously by two crankshafts geared together, and are so arranged that when one slide is open, the other is fully closed, both valves being half-way open at the mid-position of the unit. The movement of each slide valve from open to closed is effected by 180 deg rotation of its crankshaft. Hot air is led to one inlet port and cooled air to the other, the

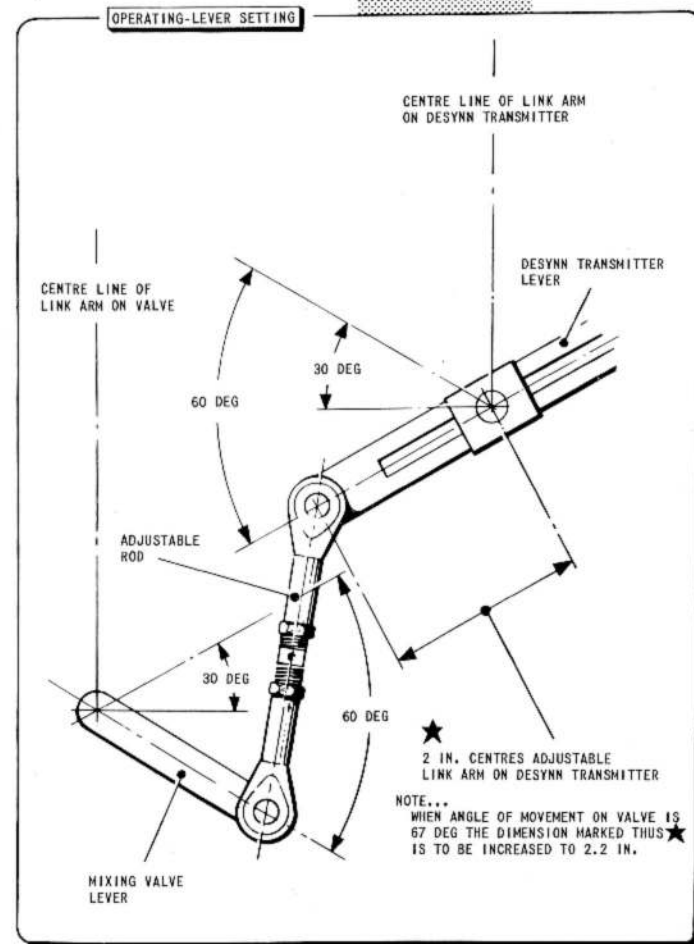
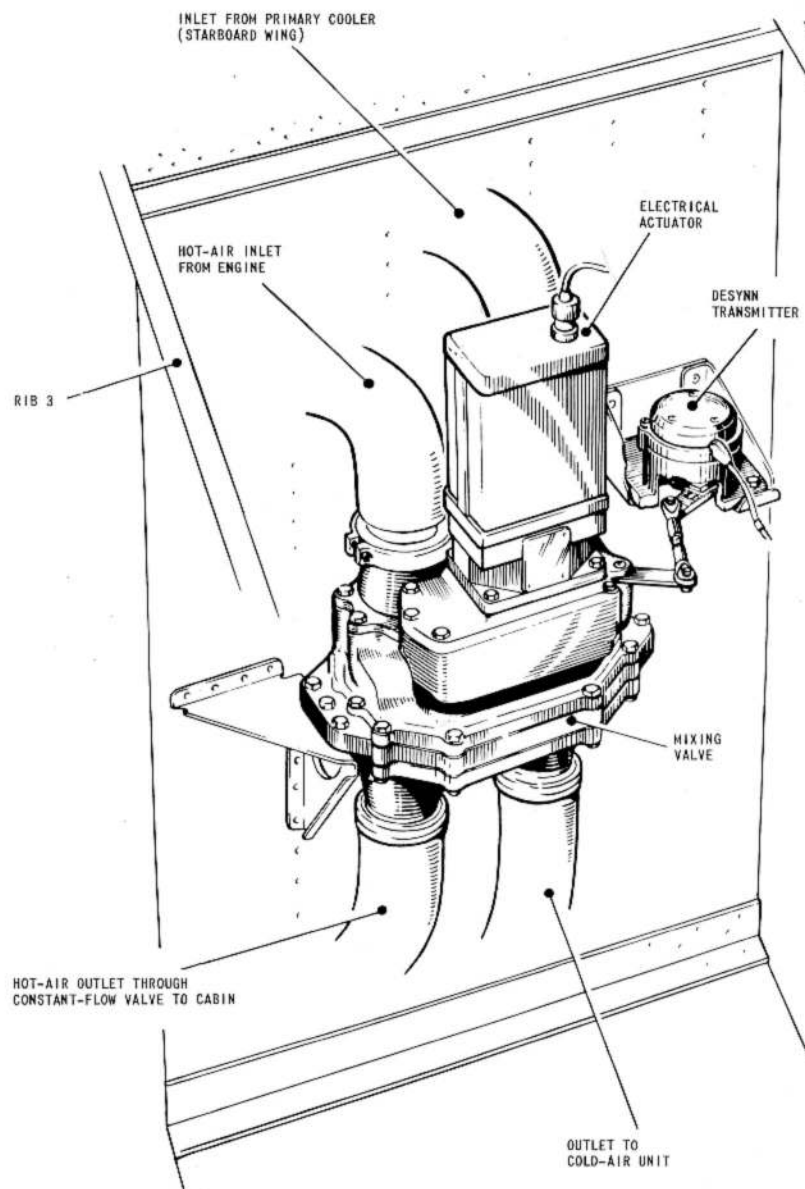


FIG. 5. MIXING VALVE

two air streams being entirely separate within the valve. The hot-air stream is directed to the cabin duct without any cooling, and the cooled-air stream from the primary cooler (para.10) is further cooled in the cold-air unit (para.12), and the secondary cooler (para.10). Mixing occurs downstream of the cold-air unit, and temperature control is effected by varying the air flow through the cooling system and the cooling system by-pass. The valve is operated by an electrical actuator controlled by the CABIN AIR switch mounted on the miscellaneous instrument panel; the switch is spring-loaded to the off position, and must be held to COLD or HOT until the desired position of the mixing valve is attained. The valve setting is indicated to the pilot by a Desynn transmitter connected to the valve by an adjustable tie-rod, and registering on the CABIN AIR indicator adjacent to the control switch.

Cold-air unit

12. The cold-air unit, installed in the leading edge of the port main plane, consists of a turbine driving a centrifugal compressor, both being mounted on a common shaft and operating in separate chambers. The motive power for the unit is supplied by air passing through the mixing valve from the engine compressors. The unit is inoperative when the mixing valve is in the fully HOT position. Mod. 2316 re-routes the cold-air unit oil sump breather pipe, from the generator exhaust duct, to a waste oil collector bottle mounted on the aft face of the forward wheel-well diaphragm.

Relief valve

13. A relief valve, mounted on the top of, and venting into, the secondary cooler outlet duct, will operate if excessive pressure occurs in the ducting between the cold-air unit and the secondary cooler.

Constant-flow valve

14. A constant-flow valve, incorporating a removable filter, maintains the flow of hot air from the engine compressors at a reasonably constant level and hence minimizes the amount of adjustment needed to keep the cabin at a comfortable temperature.

Water extractor

15. A water extractor, positioned in the main cabin supply duct just aft of the pressure bulkhead, prevents the formation of condensation in the pressure cabin. The extractor is mounted on the nose wheel-well wall in the port equipment compartment and is drained through a small pipe leading to an outlet on the underside of the fuselage skin.

Non-return valves

16. Two non-return valves, fitted in the main supply duct adjacent to the engine compressor tapings, safeguard against system pressure loss back through the engine in the event of a single engine failure. Another non-return valve positioned, together with an adapter, in the main cabin supply duct just aft of the pressure cabin, prevents loss of cabin pressure should there be a leak or failure in the system.

Cabin pressure control unit

17. The pressure controller, mounted on the lower starboard side of the pressure bulkhead, maintains, in conjunction with the combined valve unit, a cabin pressure greater than atmospheric at all altitudes above 10,000 ft; the difference between these two pressures is termed the differential pressure. The unit regulates the pressure in the cabin by adjusting the opening of the discharge valve in the combined valve unit, thus controlling the discharge of air from the cabin. The controller is designed to initiate cabin pressurizing at approximately 10,000 ft, and to build up and maintain a maximum differential pressure of 3.5 lb/in² at 25,000 ft and above. Below 10,000 ft, cabin and atmospheric pressures are approximately the same. The vent plates for the static pipeline from the controller are positioned on either side of the fuselage just aft of frame 4.

Combined valve unit

18. The combined valve unit, mounted on the aft face of the pressure bulkhead, regulates the cabin pressure, in conjunction with the cabin pressure control unit (para.17), by controlling the rate at which air is allowed to escape from the cabin. Two safety valves are incorporated in the unit and, should the cabin pressure rise to more than 4.2 lb/in², both valves will open, allowing the excess pressure to vent to atmosphere. An inward-relief valve limits, to a safe value, the amount of negative differential pressure which may occur in certain circumstances, such as rapid descent following engine failure.

Pressure warning system

19. An electrical warning horn is mounted on the starboard side of the pressure cabin just aft of the entrance door. It is operated by the cabin pressure control unit and gives audible warning when the cabin pressure falls to a dangerous level. An override switch for the warning horn is situated on the miscellaneous instrument panel.

Pressure cabin sealing (fig.6)

20. The entrance door, pilot's canopy and crew escape hatch, are sealed by rubber sealing strips and bushes. All electrical connections, controls, etc., passing through the pressure bulkhead are also sealed, typical examples being given in fig.7. The sealing of the joints in the cabin structure is made with Peratol and Bostik sealing compounds.

SERVICING**WARNING**

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

General information

21. The following paragraphs detail the methods of function testing the cabin pressure system, for information on the servicing of an individual component within the system, refer to the A.P. listed adjacent to the component in Table 1. General cleanliness and security of installation must be maintained throughout the system and this must include special attention to the cleaning of air filters within the constant-flow valve and the combined valve unit.

Note...

1. With the exception of SILASTIC hose joints, the standard procedures for remaking hose joints must be adopted (A.P.101A-0300-1A). To remake the SILASTIC hose joints, proceed as follows:-

(a) Renew the SILASTIC hose.

(b) Ensure that the gap between the pipe ends to be connected is between 0.10 in. and 0.50 in.

(c) Fit the hose clips using clamping rings (Pt. No. EEAS.66/14) beneath each clip.

(d) Fully tighten the hose clips; ensure that the gap between the ends of the clamping ring beneath each clip is between 0.50 in. and 0.70 in.

2. When assembling box-type lagging, ensure that the Jubilee securing clips are not over-tightened which may result in the lagging collapsing. To avoid this, tighten the clips to the stage where they can just be moved by hand.

3. To prevent seizure of metal-to-metal couplings molybdenum disulphide anti-seize compound (ZX-38) must be applied to the threads of the unions on reassembly.

4. To avoid distress or discomfort to the crew from objectionable odours generated in the system and transmitted to the cabin, the following precautions are to be taken:-

a. When pipes or ducts are disconnected they are to be blanked off to exclude foreign matter.

b. Replacement non-metallic pipes must bear a red rectangle. Whenever a new pipe is to be fitted, it is first to be blown through with hot air from a non-toxic heater for a minimum period of 30 minutes at a temperature of 85 deg C. During this time the pipe is to be checked for odours and rigidity, any pipe which softens or continues to generate odours after this period is to be rejected and reported defective.

c. New components and metallic pipes fitted to the system must be thoroughly degreased if they carry cabin air through ducts or apertures or can contaminate the system in any way.

d. When any part of the system has been disturbed, a check, with engines running, is to be made to ensure that the system is functioning satisfactorily, does not leak, and with full cabin heat selected does not give off odours.

Test points

22. A test point, positioned in the main hot air duct from the engine, is located in each inner main-plane leading edge; either point may be used for pressure testing the pipelines of the system. A third test point and a pressure gauge connection are fitted on the rear face of the pressure bulkhead and are accessible from the nose-under-carriage well; these are used when pressure-testing the cabin (para.25).

Pressure-test of pipelines

23.

(1) Disconnect and securely blank off the following connections:

Mixing valve to cold-air unit, at the cold-air unit inlet.

Mixing valve to constant-flow valve (leading edge equipment bay), at the constant-flow valve inlet.

Both engine compressor delivery pipes, at the engine compressor. (Blank off engine compressor casing outlet ducts to prevent ingress of foreign matter.)

(2) Connect a Mk.4 electrical supply trolley Ref.No.4F/1913 to the external supply socket (Sect.2, Chap.2) and set the mixing valve at COLD.

(3) Open both engine gate valves.

(4) Connect a Type L, Mk.2 or 2A test trolley Ref.No.4F/1693,1783 to the test point in either the port or starboard leading-edge equipment bay.

(5) Start the test trolley and raise the pressure in the system to 80 lb/in².

(6) Stop the test trolley and check the time taken for the pressure to drop to 30 lb/in². This must not be less than 10 min.

(7) Check all joints and pipelines for leaks using a soap and water solution.

(8) Release the pressure and remove all traces of the soap solution.

(9) Disconnect the test trolley and refit the blank to the test point.

(10) Remove the blanks fitted in operation (1) and reconnect the pipes. Wirelock all pipe unions.

(11) Close the engine gate valves and return the mixing valve to the HOT position.

Functioning test with test trolley

24.

(1) Ensure that the cold-air unit is filled with oil (Sect.2, Chap.2).

(2) Disconnect the main supply pipe at the starboard engine compressor and connect a pressure test trolley, incorporating a 0-100 lb/in² pressure gauge, to the supply pipe.

(3) Connect a Mk.4 electrical supply trolley to the external supply socket (Sect.2, Chap.2)

(4) Select HOT at the cabin heat control switch, and move the starboard engine gate valve switch to ON. Both of these switches are situated on the starboard instrument panel.

◀(5) Start the test trolley to give a pressure of 80 lb/in² to the system, and check that air is flowing at all distribution outlets, i.e. cabin louvres and diffusers. ▶

(6) Disconnect the mixing valve to the cold-air unit pipe, and check that there is no air flow. (Should there be an air flow, check that the mixing valve actuator is operating correctly (Sect.6, Chap.6); if it is the mixing valve at fault it should be replaced.)

(7) Reconnect the mixing valve to the cold-air unit pipe.

(8) Remove the test trolley, reconnect the supply pipe to the engine compressor and connect the test trolley to the delivery pipe at the port engine compressor.

(9) Select COLD at the cabin heat control switch and switch the port engine gate valve switch ON and the starboard OFF.

(10) Start the test trolley and check the flow of air at the cabin louvres and diffusers operation (5).

(11) Visually check that the cold-air unit is running by disconnecting the pipe from the cold-air unit outlet. Reconnect the pipe.

(12) Remove the test trolley, and reconnect the delivery pipe at the port engine compressor.

(13) Select HOT at the cabin heat control switch, and move the port engine gate valve switch to OFF.

(14) Disconnect the electrical supply trolley.

Cabin pressure tests

Methods of testing

25. Cabin pressurization tests can be carried out using a test trolley or by running the engines. The using of a test trolley allows functioning checks to be made on the cabin pressure controller and the combined valve unit, it also allows the cabin structure to be checked for leaks and distortion. When it is necessary to function-test the complete system the engines must be run.

WARNING...

1. Pressure must not exceed 3.5 lb/in² with personnel inside the cabin.

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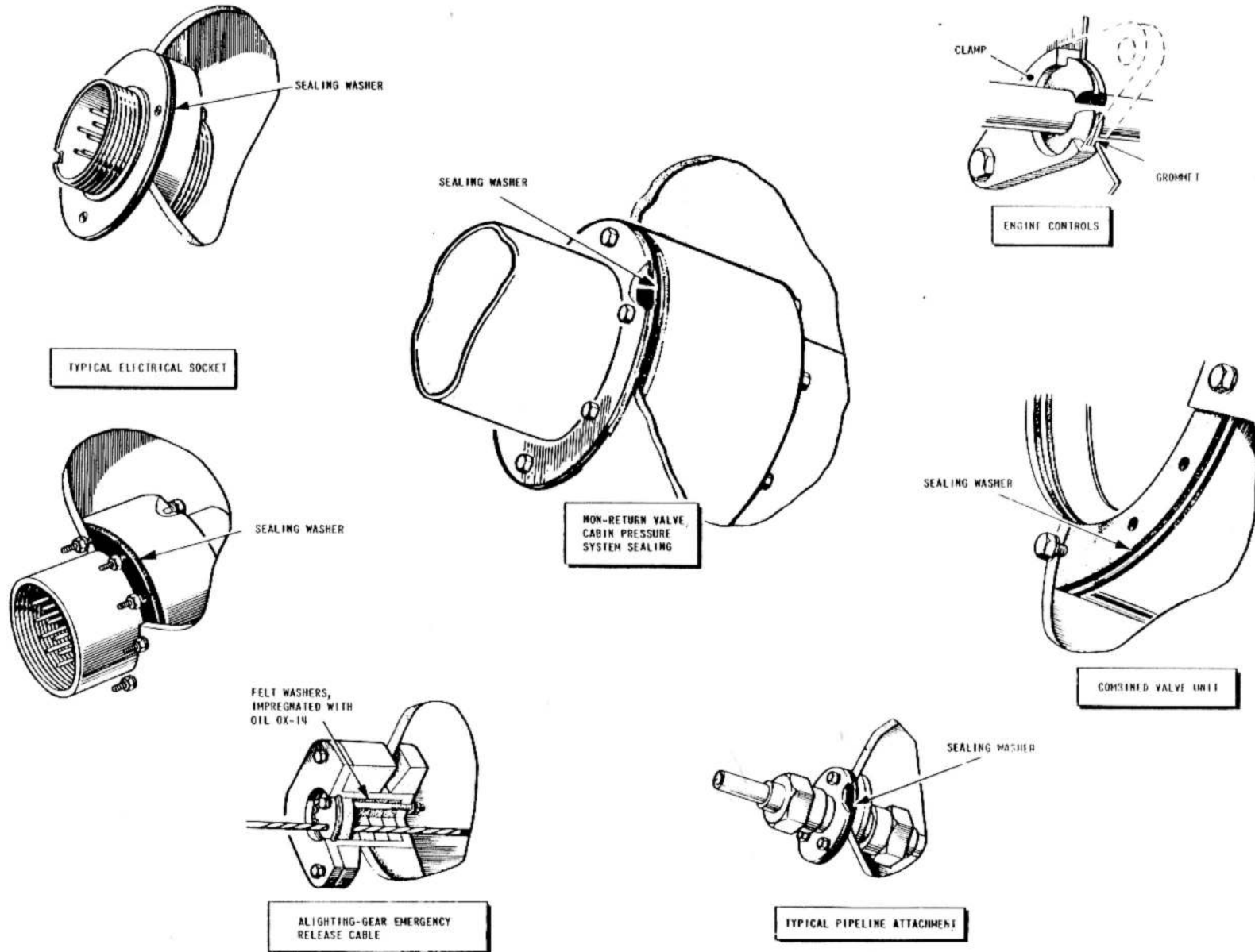


FIG. 7. PRESSURE BULKHEAD SEALING

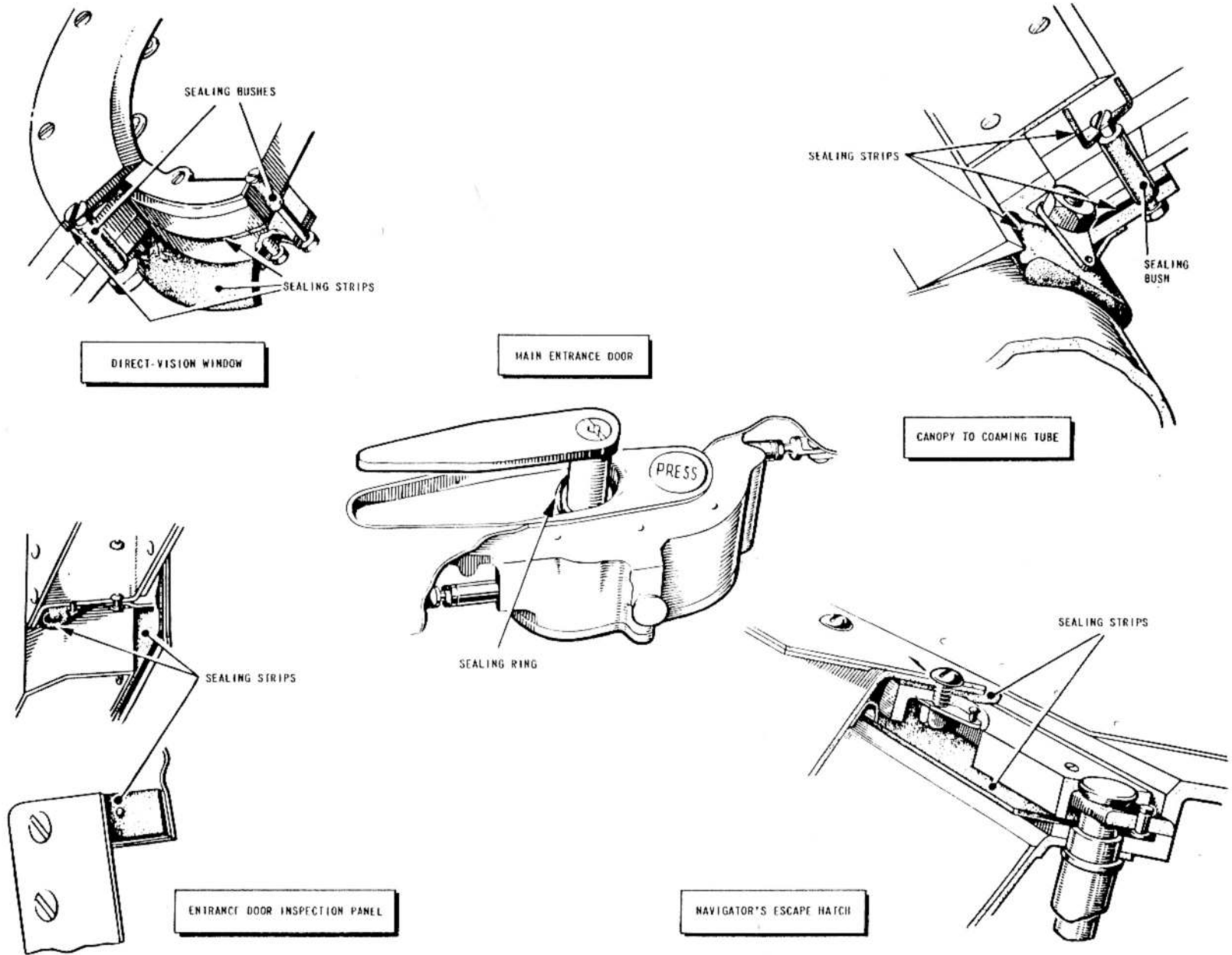


FIG. 6. PRESSURE CABIN SEALING

(10) Remove the blanks fitted in operation (1) and reconnect the pipes. Wirelock all pipe unions.

(11) Close the engine gate valves and return the mixing valve to the HOT position.

Functioning test with test trolley

24.

(1) Ensure that the cold-air unit is filled with oil (Sect.2, Chap.2).

◀(2) Disconnect the main supply pipe at the starboard engine compressor and connect a pressure test trolley, incorporating a 0-100 lb/in² pressure gauge, to the supply pipe. ▶

(3) Connect a Mk.4 electrical supply trolley to the external supply socket (Sect.2, Chap.2)

(4) Select HOT at the cabin heat control switch, and move the starboard engine gate valve switch to ON. Both of these switches are situated on the starboard instrument panel.

(5) Start the test trolley to give a pressure of 80 lb/in² to the system, and check that air is flowing at all distribution outlets, i.e. cabin louvres, diffusers, and the ventilated suit cocks.

(6) Disconnect the mixing valve to the cold-air unit pipe, and check that there is no air flow. (Should there be an air flow, check that the mixing valve actuator is operating correctly (Sect.6, Chap.6); if it is the mixing valve at fault it should be replaced.)

(7) Reconnect the mixing valve to the cold-air unit pipe.

(8) Remove the test trolley, reconnect the supply pipe to the engine compressor and connect the test trolley to the delivery pipe at the port engine compressor.

(9) Select COLD at the cabin heat control switch and switch the port engine gate valve switch ON and the starboard OFF.

(10) Start the test trolley and check the flow of air at the cabin louvres and diffusers operation (5).

(11) Visually check that the cold-air unit is running by disconnecting the pipe from the cold-air unit outlet. Reconnect the pipe.

(12) Remove the test trolley, and reconnect the delivery pipe at the port engine compressor.

(13) Select HOT at the cabin heat control switch, and move the port engine gate valve switch to OFF.

(14) Disconnect the electrical supply trolley.

Cabin pressure tests

Methods of testing

25. Cabin pressurization tests can be carried out using a test trolley or by running the engines. The using of a test trolley allows functioning checks to be made on the cabin pressure controller and the combined valve unit, it also allows the cabin structure to be checked for leaks and distortion. When it is necessary to function-test the complete system the engines must be run.

WARNING...

1. Pressure must not exceed 3.5 lb/in² with personnel inside the cabin.

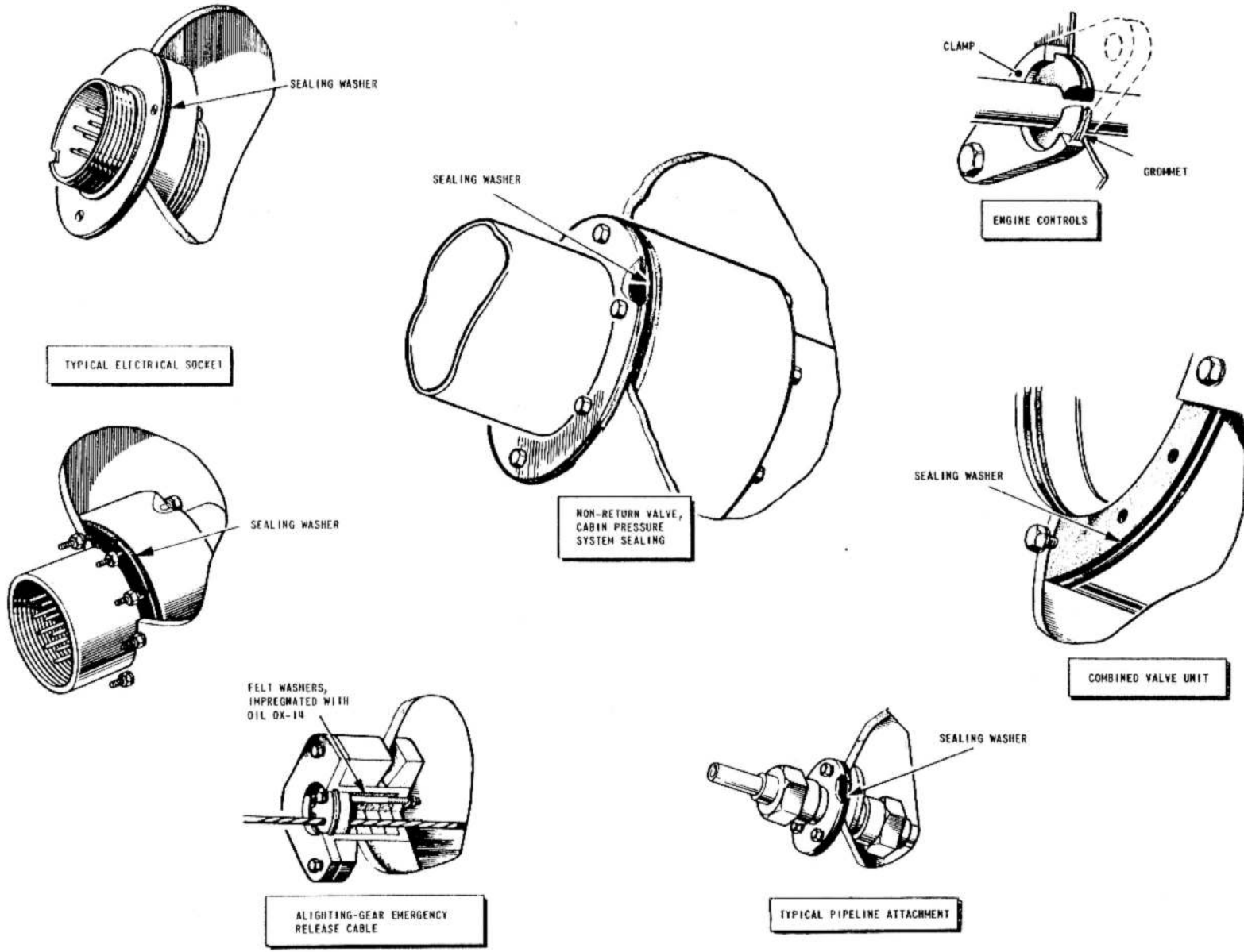


FIG. 7. PRESSURE BULKHEAD SEALING

2. Only personnel certified by the Station or Unit Medical Officer as fit for servicing duties inside pressure cabins are permitted inside the pressurized portion of an aircraft during tests at ground level. Personnel with colds must have further medical approval.

3. At no time is the cabin pressure to exceed 4.7 lb/in².

4. Upon completion of a pressure test, the cabin entrance door must not be opened until the pressure gauge reads zero and two minutes have elapsed to allow any residual pressure to escape.

Note...

During pressure tests, each control passing through the rear pressure bulkhead must be operated very slowly, at least three times, over its entire range.

With test trolley

26. Test the pressure cabin in the following manner, using a Mk.1C pressure cabin testing trolley Ref. No. 4F/1714; operating instructions are given in A.P.119F-1508-126A. ▶

(1) Ensure that the canopy de-misting system units are installed and connected.

◀(2) Remove all static vent plugs and fit static vent blanks Ref. 6C/1059239 to cabin pressure system. ▶

(3) Remove the blanking cap from the pressure gauge connection on the rear face of the pressure bulkhead, accessible from inside the nose undercarriage well, and fit a 0 to 10 lb/in² pressure gauge to the connection.

(4) Ensure that air supply adapter Ref. No. 4F/1807 is fitted to the delivery hose of the ground testing trolley, and connect the hose to the ground test connection on the rear face of the pressure bulkhead; access is from inside the nose undercarriage well.

◀(5) With the entrance door and direct-vision window closed, pressurize the cabin and record the pressure at which the safety valve cracks open.

This pressure is to be $4.2 \begin{matrix} + 0.00 \\ - 0.25 \end{matrix}$ lb/in², with an airflow of 5 lb/min.

(6) Check the cabin structure for signs of permanent distortion and, using a soap-and-water solution, check for leaks.

(7) Stop the testing trolley and, with a stop watch, note the time taken for the pressure to drop from 3.5 to 1.75 lb/in². This must be not less than 35 sec.

Note...

If the time taken is less than 35 sec, rectify the leaks noted in operation (7) and repeat the pressure test.

(8) Remove the delivery hose and pressure gauge from the pressure bulkhead ground test connection and refit the blanking caps.

(9) Check the operation of the warning horn. (As this does not function during cabin pressure tests on the ground, make the electrical test detailed in Sect.6, Chap.6.)

(10) Remove the static vent blanks Ref. 6C/1059239 and fit all static vent plugs. ▶

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With engines

WARNING...

When the aircraft is stationary, there is no cooling airflow through the primary and secondary coolers. Prolonged ground running with COLD selected is therefore to be avoided, and with the engines running (speed not to exceed 5000 rev/min continuously) the cold-air unit must not be operated for longer than ten minutes during any one period. It is permissible however, to use the cold-air unit whilst taxiing.

27. To pressure test the cabin using the engines:-

(1) Ensure that the canopy de-misting system units are installed and connected.

(2) Remove the static vent plugs.

(3) Ensure that the cold-air unit is filled with oil (Sect.2, Chap.2).

(4) Disconnect the pipe which connects the combined valve unit to the pressure controller, at the combined valve unit, and blank off the pipe only, using plug Ref. No. 26FZ/95270.

(5) Before starting the engines, operate the cabin heat control switch to secure full travel of the mixing valve and note the time taken for this operation; it should be approximately three seconds in each direction. Switch the mixing valve to the COLD position.

(6) Start the engines and, with the port engine running at 5500 rev/min and the starboard engine idling, check that air enters the cabin. Operate

the cabin heat control switch and check the time taken for the mixing valve to move from one extreme of travel to the other. The maximum time for this operation in each direction is five sec.

(7) With the starboard engine running at 5500 rev/min and the port engine idling, repeat operation (6).

(8) Close the entrance and, with both engines running at 5500/6000 rev/min, and using a hand pressure gauge (boost gauge Ref. No. 6A/1279), make the following tests:-

(a) With the mixing valve selected to HOT on the cabin temperature control switch, check that the time taken for the pressure to rise to 3.5 lb/in² does not exceed 60 sec.

(b) Select the mixing valve to COLD and check that the time taken for the pressure to rise to 3.5 lb/in² does not exceed 60 sec.

(c) When the cabin temperature control switch is operated, check that the temperature of the air entering the cabin agrees with that indicated on the temperature gauge adjacent to the control switch.

(d) With the port engine idling and the starboard engine running at 5500 rev/min, check that the cabin pressure can be maintained for at least three minutes. Repeat test with starboard engine idling and the port engine running at 5500 rev/min.

(e) Switch the engine gate valves OFF, and with both engines idling, check the time the pressure takes to fall from 3.5 lb/in² to

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1.75 lb/in². This must not be less than 35 sec. Check also that there is no air entering the cabin through any louvre or diffuser.

Note...

If the results of the above cabin pressure checks are unsatisfactory, leak test the cabin (para.26, operation (7)) and rectify any leaks found. Repeat operation (8) and if the results are still unsatisfactory the air conditioning system components are suspect.

(9) When all the cabin pressure has been released remove the blanking plug from the pressure controller pipe and reconnect the pipe to the combined valve unit.

(10) Close all doors and apertures, OPEN the engine gate valves and select HOT on the temperature control switch. Run both engines at 5500 rev/min and check the cabin pressure does not exceed 1.0 lb/in².

Note...

The hot and cold pressurizing are to be regarded as two independent systems. Times and pressures are to be recorded under both headings.

Test to be undertaken after a major repair

28. The cabin must be pressure tested whenever the canopy, hatch or any other major component affecting cabin pressure, has been renewed or repaired.

Sealing

29. Two alternative types of sealant, Bostik and Peratol, were used for sealing the pressure cabin

during manufacture, but for repair, or pressure leak rectification, Bostik only should be used. Particulars of Bostik sealing compound for repairing damaged sealing are given in A.P.1464B, Vol.1, Sect.4, Chap.7, and details of the method of application are given in A.P.101B-0400-6, Part 1, Chap.2.

Alighting-gear emergency release cable

30. This cable passes through the pressure bulkhead by way of a pressure sealed barrel. The barrel houses seven felt sealing washers which are impregnated during assembly with anti-freeze oil (OX-14). If the emergency lowering control has been operated it is necessary to re-impregnate the sealing washers with the above oil; for information on their removal refer to fig.7.

REMOVAL AND ASSEMBLY

General information

31. The following paragraphs give the recommended methods of removing certain components from the air conditioning system. Generally the assembly sequence is the reverse of the removal but special assembly features are specifically mentioned. With the exception of SILASTIC hose joints, the standard procedure for remaking hose joints must be adopted (AP 101A-0300-1A). To remake the SILASTIC hose joints, proceed as follows:-

- (1) Renew the SILASTIC hose
- (2) Ensure that the gap between the ends of the pipes to be connected, is between 0.10 in. and 0.50 in.
- (3) Fit the hose clips using clamping rings Part No. EEAS.66/14 beneath each clip.

(4) Fully tighten the hose clips, and ensure that the gap between the ends of the clamping ring beneath each clip is between 0.05 in. and 0.07 in.

The following must be observed when reassembling lagging and metal-to-metal couplings:

(5) Whenever box-type lagging is removed, care must be taken on reassembly that the Jubilee clips securing the lagging are not over-tightened to the extent of crushing the lagging; it is considered satisfactory that the clips be tightened to the stage where they can be just moved by hand.

(6) To prevent seizure of metal-to-metal couplings, molybdenum disulphide anti-seize compound (ZX-38) must be applied to the threads of the unions on reassembly.

◀ (7) To avoid distress or discomfort to the crew from objectionable odours generated in the system and transmitted to the cabin, the following precautions are to be taken:-

a. When pipes or ducts are disconnected they are to be blanked off to exclude foreign matter.

b. Replacement non-metallic pipes must bear a red rectangle. Whenever a new pipe is to be fitted, it is first to be blown through with hot air from a non-toxic heater for a minimum period of 30 minutes at a temperature of 85 deg C. During this time the pipe is to be checked for odours and rigidity, any pipe which softens or continues to generate odours after this period is to be rejected and reported defective.

c. New components and metallic pipes fitted to the system must be thoroughly degreased if they carry cabin air through ducts or apertures or can contaminate the system in any way.

d. When any part of the system has been disturbed, a check, with engines running, is to be made to ensure that the system is functioning satisfactorily, does not leak, and with full cabin heat selected does not give off odours.

Mixing valve

Removal

32.

(1) Remove the access panels from the upper surface of the port inner wing leading-edge (Sect.2, Chap.4).

(2) Remove the actuator (A.P.113E-0249-1).

(3) Remove and safeguard the split

continued

pin, collar and steel pin which connect the link arm to the Desynn transmitter.

(4) Disconnect the four hose couplings at the mixing valve.

(5) Remove and safeguard the 2 B.A. nuts, bolts, washers and strengthening plates which attach the mixing valve to the mounting bracket and remove the valve.

(6) Securely blank off all of the pipe ends and valve apertures.

Installation

33.

(1) Remove all blanks from the pipe ends and valve apertures.

(2) Mount the valve on the bracket, fit the six 2 B.A. bolts, offer up the strengthening plates to the undersides of the brackets, taking care that the 0.1 in. radius fits into the corner of the bracket, and secure the assembly with the six nuts and washers.

(3) Set the mixing valve follower lever and the adjustable Desynn transmitter lever to their mid-positions (i.e. 30 deg from either end of full travel).

(4) Without disturbing the lever positions, fit the tie rod and adjust its length to obtain the dimensions shown in fig.5.

(5) Ensure that the transmitter lever has a full range of travel.

(6) Test the operation of the assembly.

Desynn transmitter

Removal

34.

(1) Disconnect the electrical cables from the transmitter.

(2) Disconnect the adjustable tie rod from the transmitter lever.

(3) Remove the four 2 B.A. attachment bolts and remove the transmitter.

Installation

35.

(1) Reverse the removal procedure; re-assemble the adjustable tie rod in accordance with para.33, operations (4), (5) and (6).

(2) Test the operation of the assembly.

Constant-flow valve

36.

(1) Remove the access panels from the upper surface of the port inner-wing leading edge (*Sect.2, Chap.4*).

(2) Disconnect the outlet pipe hose coupling inboard of rib 2.

(3) Disconnect the inlet pipe at the adapter on the port side of the valve.

(4) Release the two Jubilee clips securing the valve to the mounting bracket and remove the valve.

(5) Securely blank off the pipe ends and valve apertures.

Air coolers

Primary air cooler

37.

(1) Remove the inboard access panel from the upper surface of the starboard inner-wing leading edge (*Sect.2, Chap.4*).

(2) Disconnect the supply pipes at the inlet and outlet ports of the cooler.

(3) Disconnect and remove the clamping rings at the inlet and outlet ducts of the cooler.

(4) Remove the bolt attaching the cooler to the top support bracket and remove the air cooler, by lifting it clear of the two bottom locating brackets.

(5) Blank off pipe ends and component apertures.

Secondary air cooler

38.

(1) Remove the inboard access panel from the upper surface of the port main-plane leading edge (*Sect.2, Chap.4*).

(2) Disconnect the relief valve pipe (*Mod.1175*) at the junction on the compressor to cooler pipe.

(3) Disconnect the relief valve to outlet duct clamp.

(4) Disconnect the supply pipes at the inlet and outlet ports of the cooler.

(5) Disconnect and remove the clamping rings at the inlet and outlet ducts of the cooler.

(6) Remove the bolt attaching the cooler to the top support bracket, and remove the cooler by lifting clear of the bottom support bracket.

(7) Blank off pipe ends and component apertures.

Cold-air unit

Removal

39.

(1) Remove the access panels from the upper surface of the port inner-wing leading edge (Sect.2, Chap.4).

(2) Disconnect the inlet and outlet ducts at the cold-air unit.

(3) Disconnect the oil breather pipe from the unit.

(4) Remove the sixteen 2 B.A. attachment bolts and double-spring washers which secure the unit to the mounting brackets and remove the unit.

(5) Securely blank off all pipe ends.

Preparation

40. Prime and test the unit in accordance with A.P.4340, Sect.2, Chap.4.

Installation

41.

(1) Remove all blanking caps.

(2) Position the unit in the aircraft and secure with the sixteen 2 B.A. bolts and the 32 double-spring washers, Part No. AGS.586/C. The washers are fitted

between the bolt heads and the bracket and between the bracket and the cold-air unit.

(3) Make the connections between the unit and the inlet and outlet ducts. Ensure that the split clamps are so assembled as to give an equal gap on each side, between the halves of the clamps.

(4) Reconnect the oil breather pipe to the unit and wire-lock.

(5) Refit the oil dipstick.

(6) After installation, fill the unit with oil (Sect.2, Chap.2). ▶

Pressure controller

42.

(1) Disconnect the pipe to the combined valve unit at the base of the unit.

(2) Disconnect the static pipe at the base of the unit.

(3) Disconnect the electrical cables from the unit (Sect.6, Chap.6).

(4) Remove the nuts and washers from the two bolts securing the unit to the aircraft structure.

(5) Blank off the pipe ends and the unit apertures.

Assembly note...

When the assembly of the pressure controller is complete, test the

operation of the warning horn (Sect.6, Chap.6) and conduct the cabin pressurization test (para.25 to 27).

Combined valve unit

Removal

43.

(1) Remove the inlet grid of the unit on the forward face of the pressure bulkhead by turning it counter-clockwise and lifting it clear of the three special-to-type bolts.

(2) Disconnect the pipe to the pressure controller at the banjo union, and remove the union by unscrewing the bolt.

(3) Remove the three special-to-type bolts, and the eight 1/4 in. B.S.F. bolts and washers securing the unit, and remove from the rear face of the pressure bulkhead.

Installation

44.

(1) Remove the inlet grid from the valve unit by rotating it counter-clockwise and lifting it clear of the three special-to-type bolts.

(2) Remove the three special-to-type bolts and the banjo connection bolt containing the metering orifice, noting their respective positions.

(3) Offer up the combined-valve unit to the rear face of the pressure bulkhead, ensuring that the rubber sealing ring is fitted between the bulkhead and the valve unit, and that the metering

orifice housing is in the 7 o'clock position when viewed from the cabin.

(4) Secure the unit to the bulkhead by fitting the three special-to-type bolts, eight 1/4 in. B.S.F. bolts, and the metering orifice banjo bolt, fitting both plain and spring washers. Ensure that the three bolts are in their correct positions as noted in operation (2), and that the two washers are in their correct positions on the banjo bolt.

(5) Connect the pipe from the pressure controller to the banjo union and wire-lock the union. Check that all bolts are tight. Refit the inlet grid to the three special-to-type bolts, by rotating the grid frame clockwise to the fullest extent of the keyhole slots.

(6) Test the pressure controller (A.P. 1275A, Vol. 1, Sect. 20, Chap. 2).

(7) Pressure test the cabin (para. 25 to 27).

Relief valve (post Mod. 1175)

45.

(1) Remove the inboard access panel from the upper surface of the port main-plane leading-edge (Sect. 2, Chap. 4).

(2) Remove the clamp from the forward end of the valve, and the Jubilee clip from the rear.

(3) Remove the two bolts securing the valve to the secondary cooler and remove the valve.

TABLE 1

List of principal components

Ref. No.	Components	Type No.	A. P.	Sect.	Chap.
27UA/555	Water extractor	W. E. 30 Mk. 2B	4340	9	2
27KD/3	Pressure controller	500326	1275A	20	2
27KD/2836	Combined-valve unit	527060	1275A	20	5
27UA/492	Primary cooler	D106/8A	4340	8	1
27UA/491	Secondary cooler	D106/6A	4340	8	1
27UA/382	Cold-air unit	A. C. R. E. 9 Mk. 10E	4340	2	4
	Hot-air valve assembly	EB7. 50. 31	4303E	2	10
27V/4282	Hot-air valve	FKH/A/16			
5W/4002	Valve actuator	234			
27KD/5	Constant-flow valve	502090	4340	6	2
	Mixing valve assembly	EB7. 75. 103	4303E	2	11
27V/4281	Hot-air valve	FKH/A/15			
5W/409	Actuator	233			
6A/2133	Desynn transmitter				
27KD/6	Non-return valve	501670	107B-0905-16A. D.		
27KD/7	Non-return valve	500457	107B-0905-16A. D.		

Chapter 8C DE-MISTING SYSTEM

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DESCRIPTION

General information

1. The canopy and the navigator's window are the dry-air-sandwich type, air dryness being achieved and maintained by the use of desiccant-filled containers in static and circulatory systems respectively (fig. 1). The static drier is vented into the cabin and allows the interspace air to adjust to the changes in cabin pressure by means of inlet and outlet valves which open when the differential pressure exceeds 0.6 lb/in². The circulatory system, which incorporates an electrically-driven blower, a filter, and an air drier in closed circuit with the interspace, can be operated to eliminate any moisture that the interspace air may contain. The navigator's window interspace is connected to the canopy outlet circulating pipe and uses the canopy interspace as a reservoir for pressure adjustment. Canopy connections are the pull-off type which are designed to break easily if the canopy is jettisoned. Further de-misting of the canopy inner surface is by a warm-air diffuser mounted above the instrument panel; the diffuser is connected to the air-conditioning system main delivery duct (Chap. 8A) and is controlled by a valve mounted on the frame to port of the lighting gear control panel.

Static-air drier and valve assembly

2. This assembly is mounted on the canopy coaming cross-tube and is connected to the interspace of the canopy by a pull-off connection at the starboard, aft side. The drier is a cylinder

containing silica-gel desiccant which is the drying medium. A tell-tale window on the side of the drier gives indication when the desiccant turns pink and is no longer active. The valve assembly, which comprises two diaphragm-operated

valves, is connected to the air drier by a rubber hose secured by worm-drive clips.

Closed circuit de-misting

3. The circulating-air drier, mounted

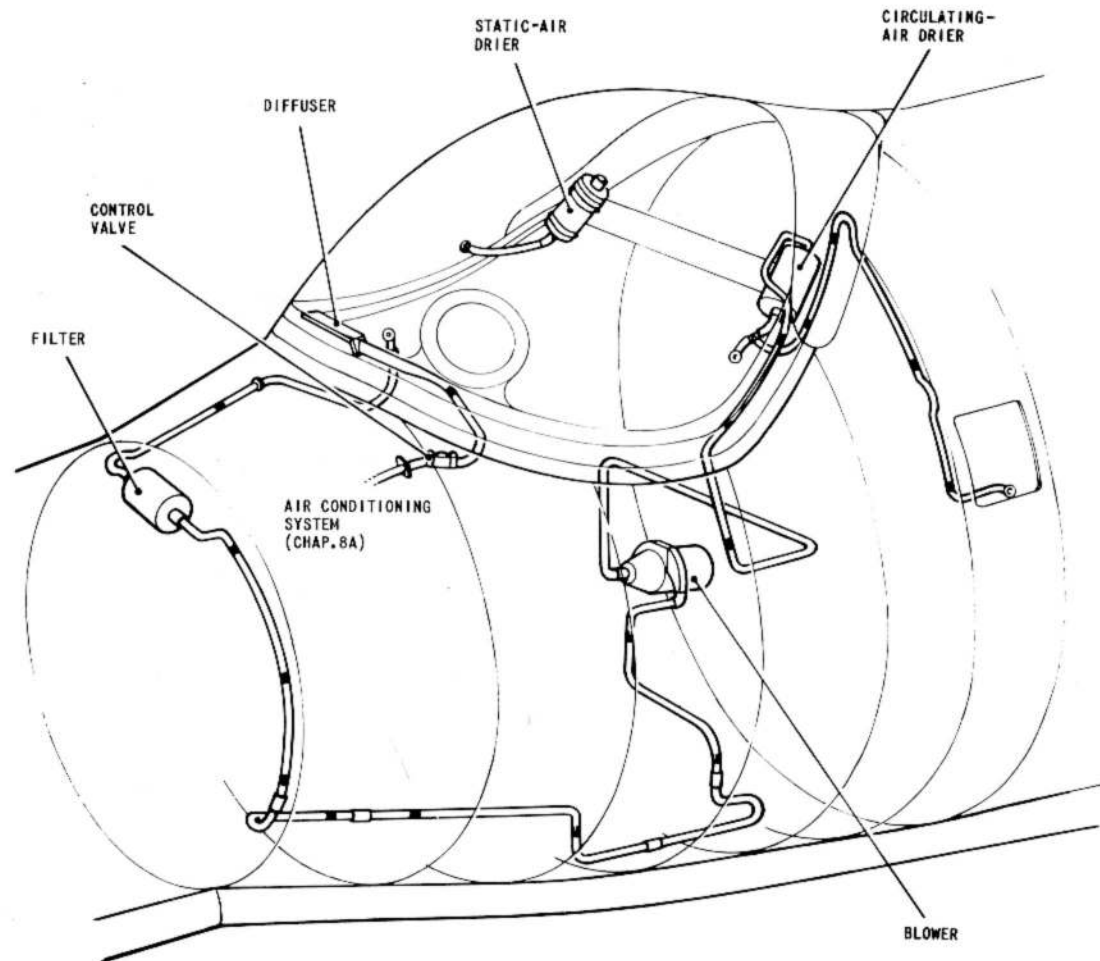


Fig. 1. De-misting system

on the coaming cross-tube, is similar to the static-air drier in that it is a cylinder containing a silica-gel drying agent. The drier is connected to the canopy interspace by a rubber tube; a T-junction in this tube is pipe connected to the navigator's window interspace and allows the enclosed air to adjust to the optimum pressure. At the outlet side of the drier, the circuit continues to the blower, which compresses the air and returns it, via a filter, to the forward canopy connection. The blower is mounted on a platform forward of, and below, the navigator's table and

is controlled by a switch mounted on the take-off panel. The filter is a standard Type M.F.A.36A element housed in a cylindrical container, and is mounted in the roof of the nose at frame 1.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

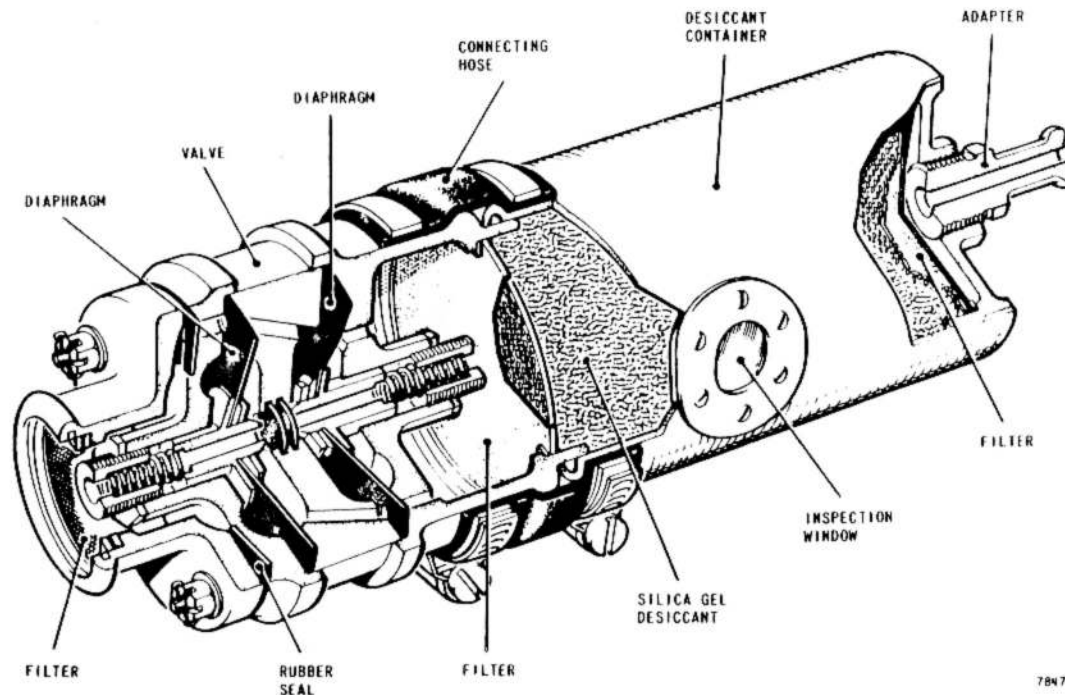


Fig.2. Static-air drier and valve assembly

Charging the air driers

Pilot's canopy static-air drier

4. The drier is fitted with a window through which the contents which are to be changed when they turn pink may be inspected. To recharge:-

- (1) Remove the blanking cap from the stowage on the canopy coaming, adjacent to the drier.
- (2) Remove the drier connection tube at the canopy and seal the canopy connection by fitting the blanking cap.
- (3) Release the mounting clips and remove the drier from the aircraft.
- (4) Slacken the worm-drive clips securing the hose connecting the container to the valve body and withdraw the container.
- (5) Empty the container and refill it with silica-gel Ref.No.33C/790.
- (6) Refit the valve to the container and tighten the worm-drive clips around the connecting hose.
- (7) Refit the drier to the aircraft and tighten the securing clips.
- (8) Remove the blanking cap from the canopy connection and connect the drier to the canopy by sliding the rubber tube on to the connection on the canopy (this connection is not to be secured with wire).
- (9) Refit the blanking cap on its stowage.

Circulating-air drier

5. This unit must be recharged with silica-gel desiccant when the contents, visible through the inspection window, have turned pink. To recharge:-

- (1) Pinch the rubber connection with a clip to prevent air entering the interspaces in the canopy or navigator's window. Similarly pinch the tube to the blower.
- (2) Disconnect the two rubber tubes at the drier.
- (3) Release the drier mounting clips and remove the drier from the aircraft.
- (4) Remove the end cap, filter and sealing rings from the drier (the end cap is secured by wing nuts) and empty the main and tell-tale compartments.
- (5) Fill both compartments with silica-gel Ref. No. 33C/790.
- (6) Refit the filter, sealing rings and end cap to the drier body.
- (7) Refit the drier to the aircraft and tighten the securing clips.
- (8) Fit the rubber tubes to the drier and clip item securely.
- (9) Remove the clips from the rubber connection tubes.

Note . . .

Take as little time as possible when re-filling the drier compartments. Moisture from the air absorbed by the crystals,

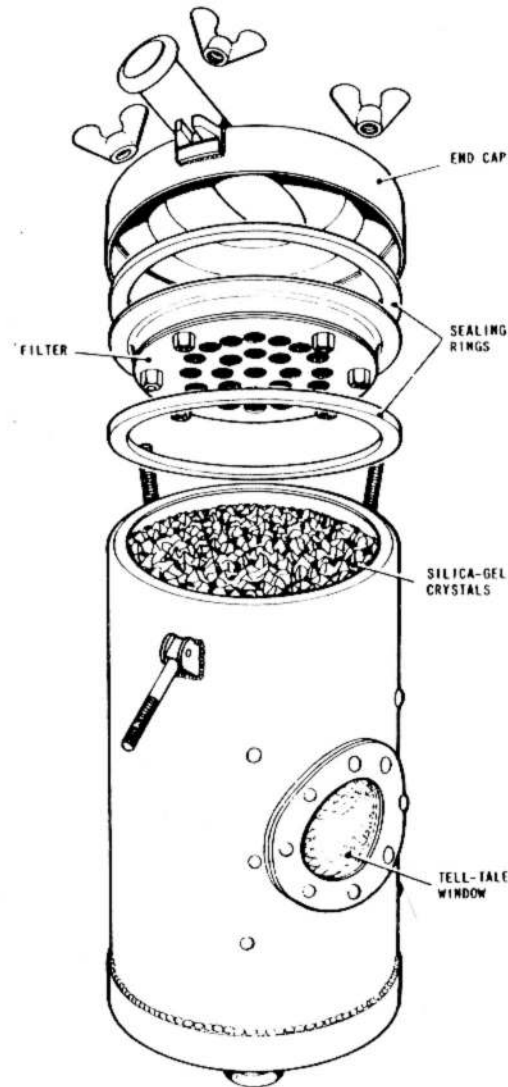


Fig. 3. Circulating-air drier assembly

reduces the efficiency and life span of the component.

Testing the sytem for leaks

6. With all of the system components assembled and with the blower motor running, use a soap-and-water solution to check for leaks.

Testing the static-air drier

7. The following equipment is required for testing the canopy static drier:-

- (1) An electrically-driven blower, Type B Mk.2, Ref. No. 4A/2626.
- (2) A 12 in. mercury U-tube (fig.4).

8. Remove the drier from the aircraft (para. 7), operations (1) to (3), and:-

- (1) Connect the air pressure pipe from the blower to the canopy end of the drier with the mercury tube interposed (fig.4). Blank off the aperture at the opposite end of the drier (fig.2).
- (2) Apply a pressure of 2 lb/in² and check that the complete assembly is airtight.
- (3) Release the pressure and remove the blank from the end of the drier.
- (4) Apply pressure and check that the outlet valve opens at 0.6 lb/in² but that it is airtight below 0.3 lb/in².
- (5) Remove the pressure pipe and connect the suction pipe in its place.
- (6) Apply suction and check that the inlet valve opens at 0.6 lb/in² but that it is airtight at 0.3 lb/in².

(7) Disconnect the blower and mercury tube and refit the drier to the aircraft.

REMOVAL AND ASSEMBLY

Filter

9. To remove the element from the filter:-

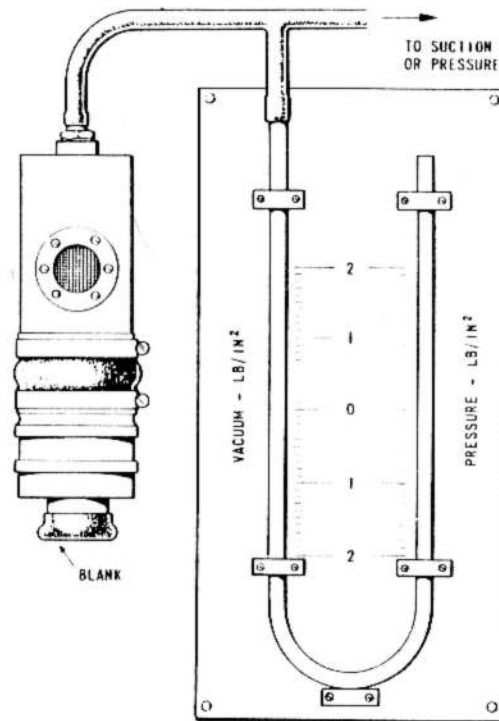
- (1) Pinch the rubber tube at the inlet connection to the canopy.
- (2) Disconnect the rubber hose from the base of the filter.
- (3) Release the filter base from the outer case by slackening the wing nut.
- (4) Remove the filter element.

10. Before assembly, lightly grease the ends of the filter with lanolin Ref.No.33C/511.

Blower motor

Access

11. To gain access to the blower motor it is necessary to remove the pilot's ejection seat and guide rail from the



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Fig.4. Static-air drier test rig

aircraft. The procedure is detailed in A.P. 109B-0101-5.

Removal

12.

- (1) Pinch the rubber tube at the inlet connection to the canopy.
- (2) Disconnect the electrical cable at the motor.
- (3) Remove the four 6 B.A. bolts securing the outlet connection to the blower and remove the outlet connection.
- (4) Remove the 2 B.A. stiffnuts from the two studs holding the inlet connection and remove the inlet connection.
- (5) Remove the 2 B.A. stiffnuts from the four bolts securing the attachment clip and remove the attachment clip and motor.

Assembly

13. This is the reverse of the removal sequence of operations. Rubber-resin cement Ref.No.33H/72 must be applied to the faces of the blower inlet and outlet connections before assembly.

TABLE 1
List of principal components

Ref. No.	Component	Part or Type No.	A.P. Reference
5UD/3310	Blower unit	Type 710, Mk. 1	A.P. 4343D, Vol. 1, Sect. 20, Chap. 13
26FZ/2841	Static-air drier and valve assembly	EA3. 76. 101	Fig. 2
26FZ/2146	Circulatory-air drier assembly	EA3. 76. 201	Fig. 3
26FZ/1815	Filter assembly	EA3. 76. 47	
26FZ/1892	Filter element	M. F. A. 36A	A.P. 1464D, Vol. 1, Sect. 3, Chap. 14
	Silicone rubber hose - Canopy	DTD 818L3	

Chapter 8D COOLING OF ELECTRONIC AND ASSOCIATED EQUIPMENT AND GENERATOR (PRE MOD.5466)
(Completely revised)

LIST OF CONTENTS

DESCRIPTION	Para.
<i>Generator and gearbox cooling</i>	1
<i>Alternator, and engine, cooling and turbine air supply</i>	2
<i>Electronic equipment cooling</i>	3

LIST OF ILLUSTRATIONS

	Fig.
<i>Generator-cooling system</i>	1
<i>Electronic equipment cooling</i>	2

DESCRIPTION

Generator and gearbox cooling

1. The generators and gearboxes are cooled by ram air ducted from a port in each main-plane inner leading edge. The air enters the generator casing, circulates around the field and armature windings, and then passes through exits in the casing to the cavity inside the shell-type gearbox cooling air containing jacket. After cooling the outer surface of the gearbox casing, the air is exhausted to atmosphere via a duct which terminates in a vent in the main-plane undersurface. Hot air from the air-conditioning system, conducted through a pipe tapped into the exhaust duct, increases the efficiency of the air-extracting system.

Alternator, and engine, cooling and turbine air supply

2. Refer to Sect.4, Chap.1.

Electronic equipment cooling

3. Cooling of the electronic equipment, mounted in the pack bay, is effected by ram air directed into the bay by scoops mounted below the central beam. The scoops, two of which are provided for the forward pack and one for the rear pack, are each fitted with electro-hydraulically-operated shutter assemblies. These can be opened or shut by the operation of a switch mounted on the A.E.O's switch panel. Near the shutter-control switch are mounted two shutter-position indicator lamps, labelled OPEN and SHUT, and controlled by microswitches fitted at the aft end of the rear pack. The operation of the shutters is described in Sect.3, Chap.1 and the electrical and hydraulic aspects of their control are separately described in Sect.6, Chap.6 and Sect.3, Chap.6 respectively. To facilitate the circulation of air to the various items of equipment in the pack, outlet holes, some of which are fitted with stack pipes, are cut in the web of the central beam. The air is exhausted from the pack bay via two hooded outlet ducts, one fitted at the aft end of each port and starboard access door.

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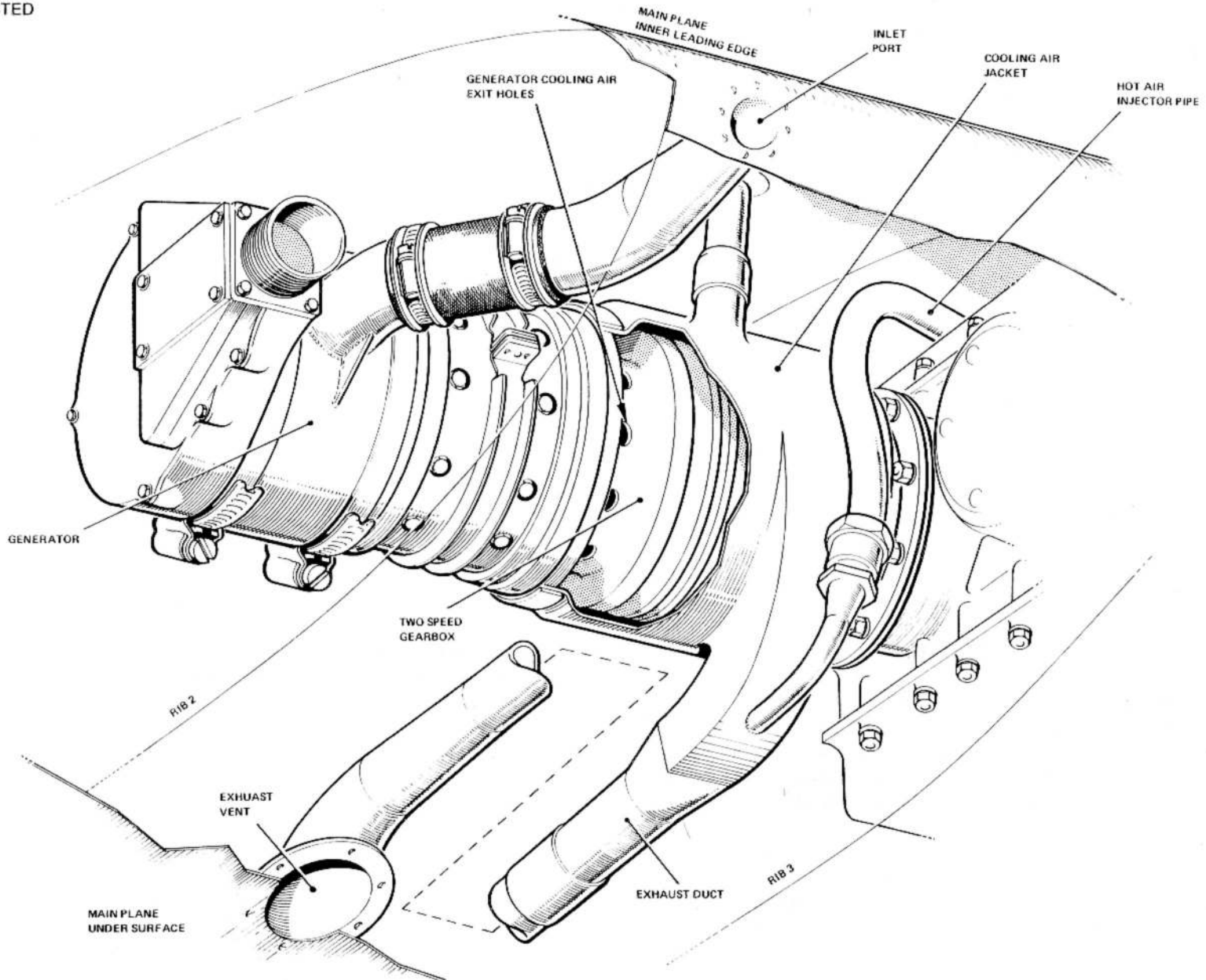
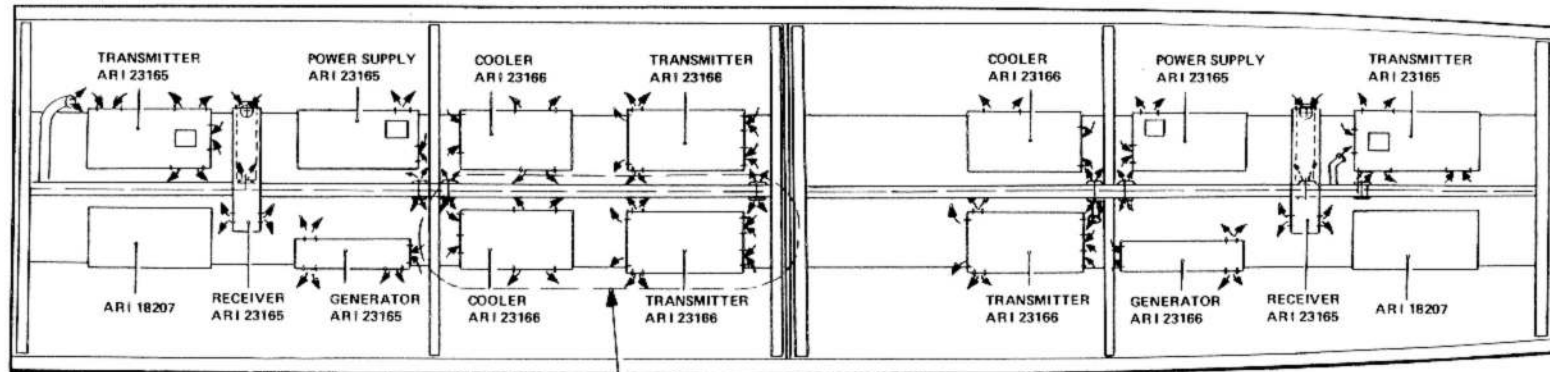
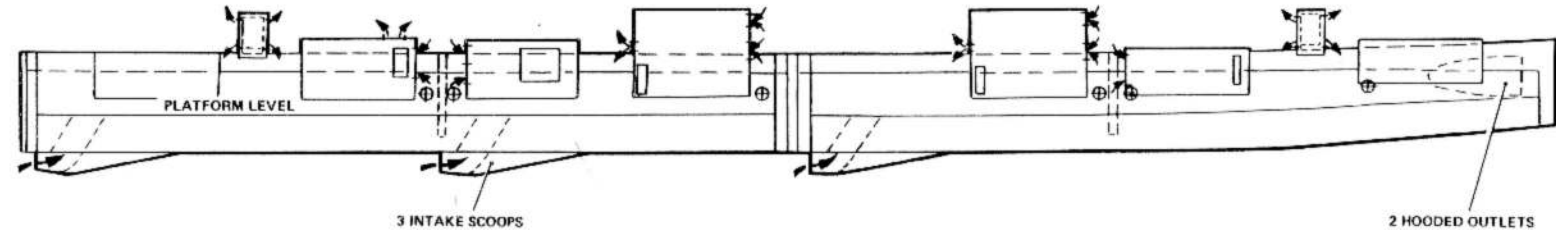


FIG. 1 GENERATOR - COOLING SYSTEM

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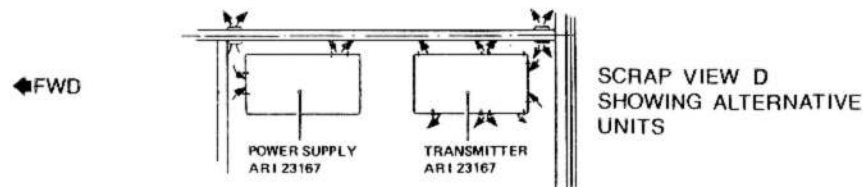


FIG.2 ELECTRONIC EQUIPMENT COOLING

Chapter 8E COOLING OF ELECTRONIC AND ASSOCIATED EQUIPMENT AND GENERATOR (POST MOD.5466)

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DESCRIPTION

Generator and gearbox cooling (fig.1)

1. The generators and gearboxes are cooled by ram air ducted from a port in each main-plane inner leading edge. The air enters the generator casing, circulates around the field and armature windings, and then passes through exits in the casing to the cavity inside the shell-type gearbox cooling air containing jacket. After cooling the outer surface of the gearbox casing, the air is exhausted to atmosphere via a duct which terminates in a vent in the main-plane undersurface. Hot air from the air-conditioning system, conducted through a pipe tapped into the exhaust duct, increases the efficiency of the air-extracting system.

Alternator, and engine, cooling and turbine air supply

2. Refer to Sect.4, Chap.1.

Electronic equipment cooling (fig.2)

3. Cooling of the electronic equipment, mounted in the pack bay, is effected by ram air directed into the central duct by scoops mounted below the central beam. The scoops, two of which are provided for the forward pack and one for the rear pack, are each fitted with electro-hydraulically-operated shutter assemblies. These can be opened or shut by the operation of a switch mounted on the A.E.O's switch panel. Near the shutter-control switch are mounted two shutter-position indicator lamps, labelled OPEN and SHUT, and controlled by micro-switches fitted at the aft end of the rear pack. The operation of the shutters is described in Sect.3, Chap.1 and the electrical and hydraulic aspects of their control are separately described in Sect.6, Chap.6 and Sect.3, Chap.6 respectively. To facilitate the circulation of air to the various items of equipment in the pack, outlet holes, some of which are fitted with stack pipes, are cut in the web of the central beam. The air is exhausted from the pack bay via two hooded outlet ducts, one fitted at the aft end of each port and starboard access door.

Note . . .

Due to the addition and deletion of certain avionic equipment the central duct air distribution pattern is changed on post modification 5466 aircraft. This is achieved by blanking redundant holes and the introduction of new holes where necessary.

WARNING

Whilst handling the cooling liquid, Coolanol, special care should be taken to avoid inhalation of any vapours given off by the liquid. Contamination of the skin should be washed off as soon as possible and irritation of eye tissues can be alleviated by washing the eye with clean warm water.

CAUTION

Extreme care must be taken to prevent spillage into the aircraft and any such spillage should be cleaned up immediately using white spirit.

Coolanol liquid cooling system

4.

(1) A major item of avionic equipment introduced under modification 5466 is the Sylvania R.F. power amplifier which requires internal liquid cooling. The liquid cooling system is located adjacent to the amplifier on the pack bay shelf, and is capable of cooling the maximum heat load of the power amplifier throughout the whole operational flight envelope. Figure 3 shows a diagrammatic layout of the system. Coolanol 25R is the cooling medium which is passed through the amplifier. It is pumped around a closed loop cooling circuit at rates of up to 0.37 kg/sec and is itself cooled by a liquid/air heat exchanger. The maximum pressure within the system will be 540 kPag at very low temperatures, the normal system pressure being approximately 450 kPag. The air supply to the heat exchanger is drawn from the pack bay by a fan which is thermostatically controlled to avoid overcooling of the coolant. Air from the pack bay central duct is guided towards the inlet of this fan to ensure a relatively cool supply of air. To avoid the ambient temperature within the pack bay becoming excessive, the outlet air from the heat exchanger is ducted overboard. The coolant enters and leaves the amplifier via self sealing couplings, these are quick release to enable removal of the amplifier from the aircraft without the need to drain the liquid system. On leaving the amplifier the coolant enters an air trap and bleed chamber across which a flow monitoring device is installed in the form of a differential pressure switch, which if the operating pressure of the unit falls below a predetermined value, the amplifier will switch into the stand-by mode and a warning light will be illuminated on the A.E.O's coaming panel. On passing through the air trap and bleed chamber, the coolant enters a reservoir. This compensates for any

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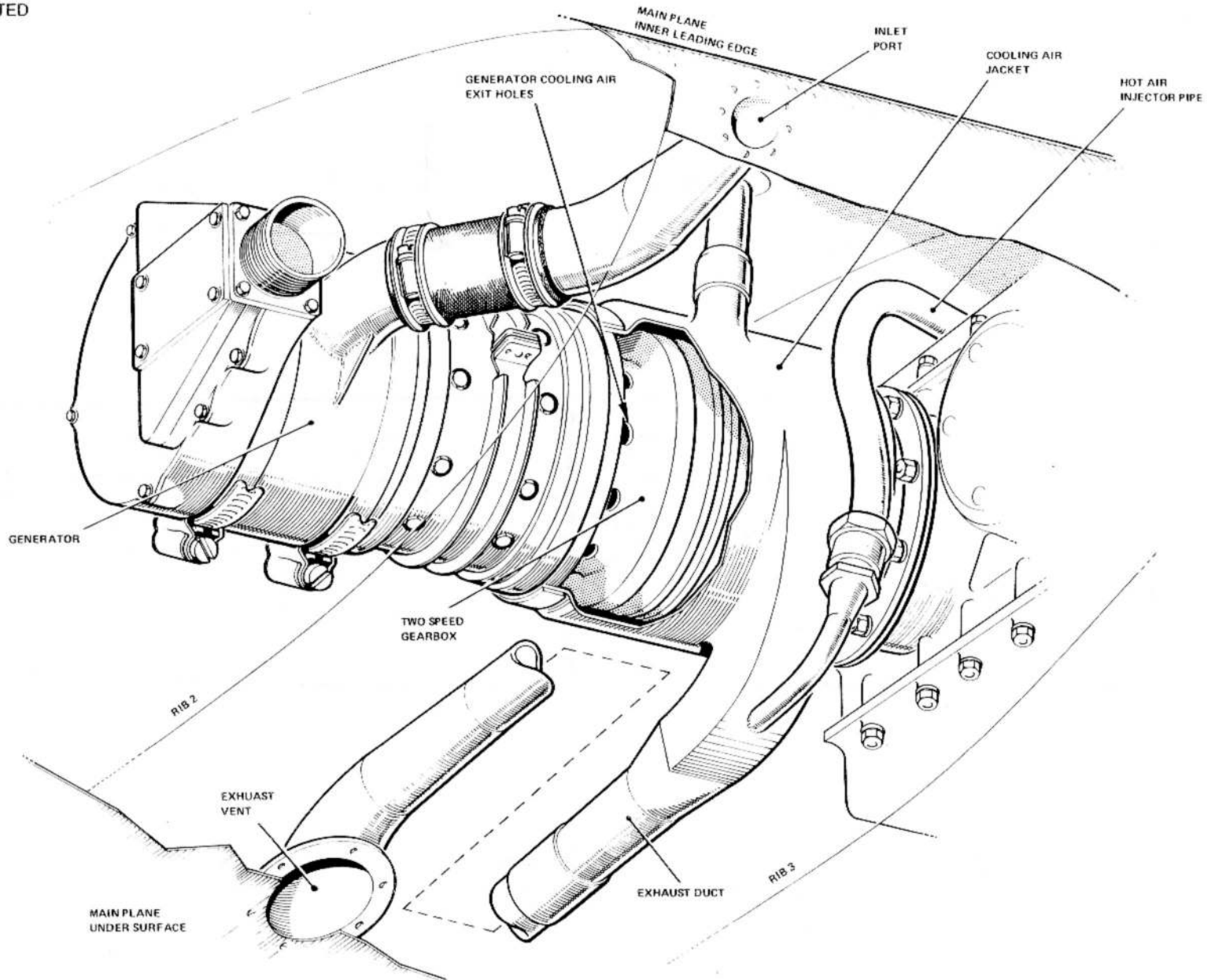


FIG.1 GENERATOR - COOLING SYSTEM

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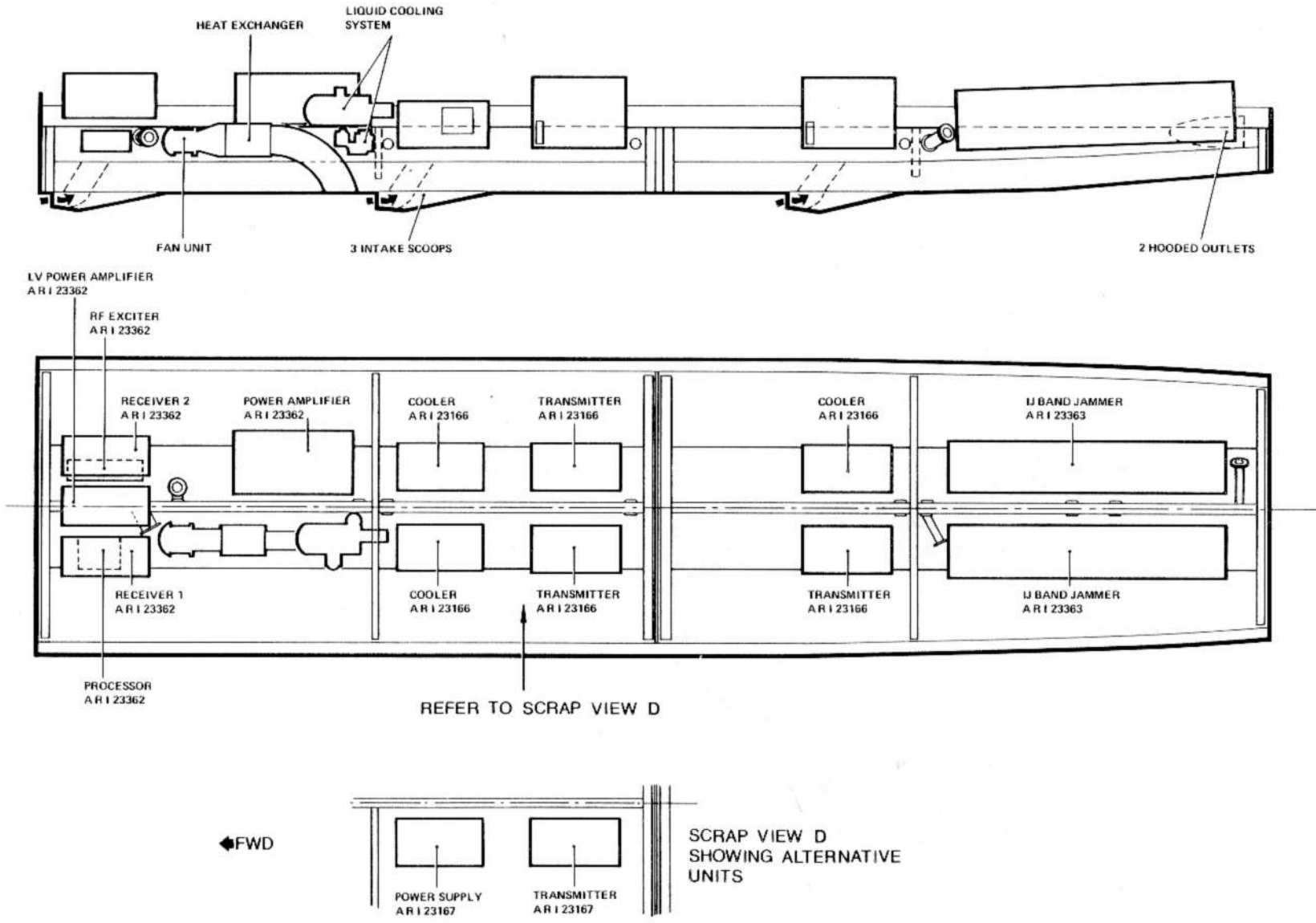


FIG.2 ELECTRONIC EQUIPMENT COOLING

thermal expansion or slight leakage of coolant from the cooling system. The reservoir also provides the inlet pressure necessary to start the pump. Between the reservoir and the pump is a pressure relief valve to prevent over-pressurisation of the system resulting from the failure of the reservoir expansion facility, or from overfilling. In this event the valve will relieve pressure from the system via an overboard drain. For the purposes of rig cooling or charging, there are self sealing ground connections across the pump inlet and outlet. The pump inlet incorporates a non-return valve to avoid reverse coolant flow through the pump. When the ground rig is connected to the aircraft a micro-switch on the ground connections electrically isolates the pump to prevent it running.

(2) *Coolant low flow rate*

In the event of the coolant flow rate falling to an unacceptably low level, due either to pump failure or system blockage, a differential pressure switch, located across the air trap and bleed chamber, will de-actuate and cause the amplifier to revert to the stand-by mode, and illuminate an indicator on the coaming panel at the A.E.O. station. The pressure switch may however, operate prematurely due to the very low flow caused by sub zero temperatures. When the switch is actuated the differential pressure necessary to sustain it in this position is such that the switch will not de-actuate until the coolant temperature falls below -17 deg C. Running of the pump on the ground prior to take off will raise the temperature sufficiently to allow the coolant flow rate to increase sufficiently to actuate the pressure switch. The length of time required to achieve the appropriate temperature is dependent upon the ambient temperature and can be calculated by using the chart on fig.5. Once the switch is actuated it can be assumed that the temperature has risen to -7 deg C or greater and the amplifier will become fully operational until the coolant temperature falls below -17 deg C.

(3) *Control*

To enable the cooling system to function correctly the pump and fan are controlled automatically. The fan is thermostatically controlled to avoid over-cooling of the coolant as this can cause the amplifier to shut down; the fan will operate when the coolant temperature exceeds 35 deg C and cease to operate at temperatures below 25 deg C. The pump will be primarily operated by the weight on wheels switch but can also be operated by a pump override switch, located on the coaming panel at the A.E.O.'s station. This switch is a two position switch with the legends "FLIGHT" and "GROUND". With the "GROUND" option

selected the pump will run continuously providing AC and DC power are present on the aircraft. This option will be used for ground testing or running during taxi in order to heat the cold coolant. If the "FLIGHT" option is selected the pump will operate only when the weight is off wheels.

(4) *Pump Type 7509*

The pump, is specially designed for use in a closed loop system and will provide an uninterrupted supply of coolant. The pump, incorporates an integral fluid-lubricated, 3-phase, A.C. motor which features an automatic thermal protection system. The pump has a cylindrical body which houses the motor, enclosed at one end by a bearing housing and at the other by an end cap. The inlet to the pump is incorporated in the end cap along with an integral non-return valve. The pump outlet is located on the body along with the electrical connection and the mounting points. The pump rotor is supported by two carbon bearings, one in the body and one in the bearing housing. The rotor shaft is extended to carry a centrifugal type impeller which rotates in a chamber formed between the pump body and the end cap. Helical grooves in the carbon bearings and a drilling in the rotor shaft permits lubrication and cooling of the motor.

(5) *Heat exchanger Type D3620*

The liquid air heat exchanger, is made from an aluminium alloy material, the constituent layers of the matrix being brazed together. The flow configuration is a cross-contra type, the charge liquid making two passes through the matrix using a turn round tank and the cooling air making only a single straight through pass. The method of connection into the cooling system is by bolted flanges which are sealed by O-rings.

(6) *Air trap and bleed chamber Type BC100*

The air trap and bleed chamber, is designed to bleed air from the fluid of the closed loop system and vent the separated air without the loss of any fluid. The unit will operate only when there is flow within the system and will vent any air automatically if the aircraft is flying in the normal horizontal position. If the unit is inverted or subjected to negative 'g' conditions, it will cease to function as a bleed chamber. The air trap and bleed chamber comprises basically of a cup shaped body, which houses the air separating cylinder, and is enclosed by a covering assembly. The body incorporates the inlet and outlet fluid connections and provides mounting points for aircraft installation. The cover assembly supports the venting mechanism and provides the air bleed connection.

(7) Reservoir Type BOIA301288A

The coolant reservoir is a cylindrically shaped tank, one end being domed and the other having an extension of a reduced diameter. The main casing is in two parts joined together by a ring of bolts around a flanged joint. The coolant inlet and outlet connections are located on the domed end of the unit. On the domed end of the reservoir is a temperature sight gauge which gives a constant indication of coolant temperature. Also on the side of the main casing are a series of small holes through which the main piston can be seen. From these two indications the level of coolant in the system can be determined. (fig.6) These are also used when charging the system to obtain the correct level of coolant.

(8) Cooling fan Type 55A0571

The cooling fan which supplies air to the heat exchanger is a 140mm diameter axial flow fan. It is manufactured in cast aluminium alloy with the electrical motor built into the guide vane body. The motor is totally enclosed incorporating sealed for life, high quality bearings and has an electrical connection, consisting of a terminal block, located on the fan casing. The unit is mounted by the flange of the outlet which is bolted to the heat exchanger inlet duct.

Ground cooling

5. The system is capable of ground cooling with certain limitations. The cooling air for the coolant heat exchanger is drawn from the pack bay and assumes non-operation of the other avionic equipment located within this area for the amplifier cooling system to function satisfactorily. If however, there is a requirement to run the other avionic equipment within the pack bay, the temperature within the bay will increase and this may result in the air becoming unacceptably hot for use within the amplifier cooling system. This problem can be overcome by removal of the pack bay panels. *and/or opening scripts*

Component failure

6. If, any of the major components have to be replaced, or the system dismantled in anyway, then the system test procedure is to be initiated. Refer to para. 7 to 26.

SERVICING**Coolanol liquid cooling system**

7.

WARNING

Whilst handling the cooling liquid, Coolanol, special care should be taken to avoid inhalation of any vapours given off by the liquid. Contamination of the skin should be washed off as soon as possible and irritation of eye tissues can be alleviated by washing the eye with clean warm water.

CAUTION

Extreme care must be taken to prevent spillage into the aircraft and any such spillage should be cleaned up immediately using white spirit and disposable absorbent towels.

Note . . .

1. *Coolanol fluids are essentially non-toxic. No special handling instructions are necessary other than those which contribute to safe, clean and efficient operation.*
2. *Coolanol absorbs air into solution and so MUST NOT be allowed to stand in an open container.*
3. *Coolanol removed from the aircraft or the ground support trolley can ONLY be reused if the Coolanol is collected in a clean container and IMMEDIATELY returned through a filter to a container which can then be SEALED or into the reservoir of the ground support trolley.*

Ground support trolley (MT30001/378) preparation – (1)

8.

CAUTION

Provide electrical bonding of the trolley, by ensuring that the 3-phase supply is connected to it before the Coolanol supply and return hoses are connected to the aircraft.

- (1) Set the trolley level, using the adjustable feet and the spirit level on the top of the trolley.
- (2) Ensure the nitrogen cylinder contains **WHITE SPOT** nitrogen, and the pressure is a minimum of 24 Bars.
- (3) Start the pump on the ground support trolley.
- (4) When starting the trolley pump, the flow controller should be set fractionally above the minimum value and slowly increased until the pump starts.
- (5) During the starting procedure, the flow control gauge may behave erratically. This should be ignored.
- (6) The flow controller is very sensitive and will need to be moved gradually to achieve the required flow. It will be found that maximum flow (18kg/min) is achieved with the flow controller set less than half way between MIN and MAX.

CAUTION

The amplifier should be disconnected from the aircraft Coolanol system before commencing the following checks.

Aircraft system nitrogen leak check**9.**

- (1) Ensure that the bleed points in the aircraft system are **CLOSED**. Bleed point 1 is in the amplifier feed line, and bleed point 2 is on top of the coolant reservoir.
- ◀ (2)
 - a. Pre Mod.GE5540 connect test rig MT30004/378 in place of the Amplifier using adapter 1949/371T.
 - b. Post Mod.GE 5540 connect test rig EG7.88.5053 in place of the Amplifier using adapter EG7.88.5051.
- (3) Ensure that the shut-off valve on rig MT30004/378 or EG7.88.5053 is fully open and that the rig's bleed screw is closed. ▶
- (4) Check the aircraft reservoir to determine if there is Coolanol in the aircraft system. If the reservoir diaphragm covers window 'A' in this case, then the system can be presumed empty and the tests continued from para.29. Any window other than 'A' indicates Coolanol in the system and it will be necessary to drain the system before proceeding. The draining procedure is described in para.21.

CAUTION

Do not connect the trolley supply or return hoses to the aircraft ground connections until the following checks have been completed.

**Ground support trolley (MT30001/378) preparation – (2)
10.**

- (1) Complete the procedure described in para.8.
- (2) Ensure that the coolant system vent valve is **CLOSED** and the supply pressure controller is turned **FULLY** counter clockwise. Check the nitrogen vent valve (at the bottle end of the trolley) is **CLOSED**.
- (3) Open the nitrogen bottle valve on the test trolley and check that the bottle pressure gauge and interstage nitrogen pressure gauge are registering pressure.
- (4) Before carrying out the nitrogen leak test it is necessary to remove any Coolanol which is trapped in the trolley supply or return hoses by the following procedure:
- (5) Connect the supply and return hoses together using the U-shaped bridging piece which is provided with the trolley.
- (6) Turn the nitrogen pressure controller clockwise until the supply gauge reads 1,0 BAR ± 0,2 BAR.
- (7) Observe the coolant flow in the exhaust flow sight glass. When large nitrogen bubbles appear in the Coolanol in the sight glass, the hoses are empty.
- (8) Turn the nitrogen pressure controller **FULLY** counter clockwise.

Nitrogen leak test**11.**

- (1) Connect the supply hose (**RED** connection) to the aircraft. The **GREEN** connection of the return hose is to remain **DISCONNECTED**.
- (2) Turn the nitrogen supply pressure controller on rig MT30001/378 clockwise until the nitrogen supply pressure gauge reads 1,0 BAR ± 0,2 BAR.

(3) For approximately 30 seconds after achieving a supply pressure of 1,0 BAR the nitrogen flow meter will behave erratically, but after 30 seconds the meter reading should fall to zero.

Note . . .

If the nitrogen flow meter continues to indicate a flow, then there is a leak in the aircraft system which must be rectified. Before attempting to rectify any system leaks, turn the nitrogen pressure controller FULLY counter clockwise and OPEN the coolant system vent valve on rig. When the leak has been rectified, repeat the test from para. (1).

Overboard relief valve test

12. If the previous tests are satisfactory, the function of the aircraft overboard relief valve may be checked using the following procedure.

Gradually increase the nitrogen supply pressure to 1,8 BAR \pm 0,2 BAR and allow the pressure in the aircraft system to stabilize for 2 minutes. A flow in excess of 5 litres per minute, should be indicated on the nitrogen flow meter. If less than 5 litres per minute, then the overboard relief valve is functioning incorrectly and should be replaced.

Completion of tests – procedure

13.

- (1) Turn the nitrogen pressure controller FULLY counter clockwise and OPEN the coolant system vent valve.
- (2) Close the nitrogen bottle control valve.
- (3) Open the nitrogen vent valve on the side of the trolley to vent the high pressure nitrogen trapped in the trolley.
- (4) Close the nitrogen vent valve.
- (5) Disconnect the liquid hose from the aircraft.
- (6) Disconnect the electrical supply from the trolley.
- ▶ (7) Disconnect the test rig leaving the adapter in position. ◀

Filling the aircraft system with Coolanol

◀ **CAUTION**

Do not connect an amplifier unit to the aircraft liquid circuit, unless the circuit is filled with Coolanol and the reservoir level is correct. ▶



14.

Note . . .

1. Prior to filling the aircraft system with Coolanol, it is necessary to complete a nitrogen leak test as described in para.9 to 13.
2. The amplifier must NOT be connected to the aircraft cooling circuit until the system has been filled with Coolanol.
3. Check that the two bleed points on the aircraft system are CLOSED. Bleed point 1 is on the amplifier feed line, and bleed point 2 is on top of the coolant reservoir.

- ▶ (1) Connect test rig and adapter in place of the amplifier and ensure that the shut-off valve on rig is fully OPEN and that the bleed screw is CLOSED. ◀
- (2) Ensure that the Coolanol reservoir on the ground support trolley MT30001/378 is FULL of Coolanol 25R and the two bleed screws on the reservoir sight tube are OPEN.
- (3) Connect the electrical 3-phase supply to the trolley.
- (4) Connect both liquid hoses to the aircraft.
- (5) Check, that the emergency stop button on the trolley is OUT by turning it clockwise and that the three 3-phase supply indicator lamps are ON.
- (6) Ensure that the Coolanol system vent valve on the trolley is CLOSED.
- (7) Press the lamps test button and check that the 3 amber and 3 red warning lights illuminate.

- (8) Select the power supply switch on the ground trolley to ON.
- (9) Set the flow controller on the trolley to between 10 and 12 kg/min.
- (10) Set the temperature controller to 25 deg C.
- (11) Start the pump on the trolley using the following procedure. Refer to para.8 before commencing.
- (12) Select the pump switch ON, then press the pump start button and hold it in until the flow failure alarm light extinguishes. If a flow failure occurs when the button is released, press the pump start button again.
- (13) Allow the coolant to circulate for 5 minutes with the flow controllers set at 10 to 12 kg/min.

Bleeding the Coolanol system

15.

CAUTION

Do not allow Coolanol to spill into the aircraft.

Note . . .

Before bleeding begins a clean container should be placed under each bleed point, also a supply of white spirit and disposable absorbent towels should be made available.

- (1) Maintain the coolant flow rate at 10 to 12 kg/min. throughout the bleeding procedure.
- (2) Gradually open bleed point 1, then close it when a steady flow of Coolanol emerges from it.
- (3) Repeat (1) and (2) for bleed point 2.

Final visual check of the Coolanol system

16.

- (1) Increase the coolant flow rate to 18 kg/min. using the flow controller and maintain this flow for 10 minutes before proceeding with the check.
- (2) Check the overboard vent point of the relief valve and the air trap

and all pipe connections to ensure there are no leaks. If satisfactory then proceed to stop the flow of Coolanol by reducing the flow to 12 kg/min. using the flow controller on the trolley.

- (3) Select the pump switch to OFF and IMMEDIATELY disconnect the GREEN RETURN HOSE connection from the aircraft.

Setting the Coolanol fluid level

17.

- (1) Observe the reading on the Temperature Sight Gauge which is located on the forward end of the reservoir.
- (2) Using the graph located on the side of the reservoir, read off the 'ROLLING DIAPHRAGM POSITION' which corresponds to the recorded 'TEMPERATURE SIGHT GAUGE' reading.
- (3) The 'ROLLING DIAPHRAGM POSITION' thus obtained denotes the letter (on the letter scale beneath the windows in the reservoir case) against which the leading edge of the diaphragm must be located when the level of coolant in the system is correct. The diaphragm leading edge may be viewed through the windows in the reservoir case (*fig.6*). The permissible tolerance on the reservoir setting is $\pm \frac{1}{2}$ letter division as shown.
- (4) If there is excess coolant in the system (i.e. the diaphragm leading edge is between its required position and window J), gradually open the coolant system vent on the trolley until the leading edge is in the correct position then close the vent valve.

- (5) Disconnect the RED liquid supply hose from the aircraft.

- (6) Disconnect the trolley electrical supply.

Note . . .

1. *Having filled the system with Coolanol, the system function check described in para.19 must be completed BEFORE connecting an amplifier unit to the system. If however, the system has been disturbed or rebuilt following a system breakdown, it will require running in. The "Running In" procedure is described in para.18.*
2. *Once filled and the reservoir set as previously described, it is essential that the aircraft system is maintained FULL of Coolanol at all times.*

System 'running in' procedure

18.

(1) Ensure that the Sylvania Master Switch is OFF and that external supplies of A.C. and D.C. power are connected to the aircraft.

▶(2) Ensure that test rig is connected and adapter is fitted in place of the amplifier. ◀

(3) Start the aircraft coolant pump by selecting the pump override switch (located on the A.E.O's coaming panel) to the GROUND test position.

(4) Run the pump approximately 30 minutes.

(5) Switch OFF the pump by selecting the pump override switch to FLIGHT position.

(6) Reconnect ground trolley MT30001/378 and repeat para.14 (3) to 14 (10) inclusive.

(7) Select the trolley pump switch ON.

(8) Press the pump start button and hold it in until the flow failure alarm light extinguishes. If a flow failure occurs when the button is released, press the pump start button again.

(9) Allow the coolant to circulate for 10 minutes.

(10) Increase the flow to 18 kg/min. and run for another 20 minutes, then reduce the flow to 12 kg/min.

(11) After this period, reduce the flow to 12 kg/min.

(12) Select the trolley pump switch OFF and IMMEDIATELY disconnect the GREEN RETURN HOSE connection FROM THE AIRCRAFT.

(13) Check the coolant level within the system (para.17).

Note . . .

Having filled the system with coolant and ensured that the 'running in' requirements are satisfied, the system function checks described in para.19, must be completed BEFORE connecting an amplifier unit into the system.

Functioning the aircraft Coolanol system

◀ CAUTION

The power amplifier must not be connected to the aircraft system until the following checks have been completed. ▶

19.

(1) Check that the Coolanol level in the system is correct (para.17).

▶(2) Ensure that the bleed screw on test rig is CLOSED and the shut-off valve is OPEN, then connect the test rig to amplifier inlet and outlet pipes, via adapter. ◀

(3) Ensure the pump override switch is in the FLIGHT position. (The switch is located on the A.E.O's coaming panel)

(4) Connect external A.C. and D.C. power supplies to aircraft and ensure that the Sylvania master switch is OFF.

(5) Ensure the Coolanol low flow warning light is ON.

(6) Start the aircraft Coolanol pump by selecting the pump override switch to the GROUND position.

(7) Ensure that the Coolanol low flow warning light is now OFF.

(8) Compare the two pressure gauge readings on test rig MT30004/378. Pressure gauge A should read 150 KPa ± 5 KPa higher than pressure gauge B. Refer to fig.7.

(9) Stop the pump, by selecting the pump override switch to the FLIGHT position.

Temperature switch test

20.

(1) Ensure Sylvania Master Switch is OFF and that external supplies of A.C. and D.C. power are connected to the aircraft.

▶(2) Ensure that test rig is connected and adapter if fitted in place of the amplifier. ◀

(3) Complete para.14 (2) to para.14 (10) inclusive.

- (4) Start the Coolanol pump on the trolley using the procedure described in para.14 (11) to para.14 (13) inclusive.
- (5) Increase the flow to 18 kg/min using the trolley flow controller.
- (6) Increase the temperature controller setting on the rig to 40 deg C and check that the fan operates when the Coolanol achieves this temperature.
- (7) Reduce the coolant flow to 12 kg/min.
- (8) Select the pump switch OFF and IMMEDIATELY disconnect THE GREEN RETURN HOSE connection FROM THE AIRCRAFT.
- (9) Check the Coolanol level as described in para.17.
- (10) Disconnect the external A.C. and D.C. supplies and disconnect test rig and adapter.
- (11) Open bleed screw on the test rig, (to relieve any residual pressure).

Note . . .

Only when the checks described in para.17 to 20 are proved satisfactory can the amplifier be installed to the aircraft Coolanol system.

Draining the aircraft Coolanol system**CAUTION**

Ensure that the power amplifier is disconnected from the aircraft Coolanol circuit before commencing.

21.

- (1) Check the level of Coolanol in the reservoir of the ground support trolley MT30001/378.
- (2) If the level indicator is more than 100mm below the high level point then there is sufficient spare capacity in the reservoir for it to accept the Coolanol in the aircraft system. If the level indicator is less than 100mm below the high level point then Coolanol must be drained from the trolley reservoir by the following procedure:—

- (3) Open the drain valve on the right hand side of the trolley and collect the Coolanol in a clean container.
- (4) Check the position of the level indicator, and close the drain valve when sufficient Coolanol has been drained.
- (5) After collecting the Coolanol drained from the reservoir, it must be filtered IMMEDIATELY into a clean container and sealed.
- (6) Check that the Coolanol level in the system is correct. (*para.17*)
- (7) Ensure that the bleed screw on test rig is closed and the shut off valve is OPEN, then connect test rig to the amplifier inlet and outlet pipes via adapter.
- (8) Ensure the pump override switch is in the FLIGHT position. (The switch is located on the A.E.O's coaming panel)
- (9) Carry out system 'running in' procedure (*para.18*).
- (10) Ensure that the coolant system vent valve on the trolley is CLOSED and that the supply pressure controller is turned FULLY counter clockwise.
- (11) Open the valve of the nitrogen bottle on the trolley and check that the bottle pressure gauge and interstage nitrogen pressure gauge are registering pressure.
- (12) Connect both hoses to the aircraft.
- (13) Turn the nitrogen pressure controller clockwise until the supply pressure gauge reads 1.0 BAR \pm 0.2 BAR.
- (14) Observe the coolant flow in the exhaust sight glass on the trolley. When large bubbles of nitrogen appear in the Coolanol in the sight glass, the aircraft system is empty.
- (15) Turn the nitrogen controller FULLY counter clockwise.

System shut down – procedure

22.

Note . . .

If the aircraft system has been drained of Coolanol to complete the nitrogen leak test of para.9, then proceed from para.11 to 13. If the system has not been drained, then complete the following.

- (1) Turn the nitrogen controller FULLY counter clockwise and OPEN the coolant system vent valve.
- (2) Close nitrogen bottle control valve.
- (3) Open the nitrogen vent valve on the side of the trolley to vent the high pressure nitrogen trapped in the trolley.
- (4) Close the nitrogen vent valve.
- (5) Disconnect the liquid hose from the aircraft.
- (6) Disconnect the electrical supply from the trolley.
- (7) Disconnect the test rig and adapter.

CAUTION

Do not connect the amplifier to the aircraft cooling system, unless the system is filled with Coolanol and the reservoir setting is correct. The procedure for this is described in para.14.

Note . . .

Before connecting the amplifier to the aircraft Coolanol system, ensure that all the tests previously stated have been completed and the level of Coolanol in the aircraft system is correct (para.17).

Ground cooling of R.F. amplifier

23.

- (1) Ground cooling of the amplifier may be accomplished using the ground support trolley MT30001/378 and the following procedure.
- (2) Connect the amplifier to the liquid cooling pipes.
- (3) Ensure that the bleed points on the aircraft system are CLOSED.

- (4) Complete para.14(2) to 14(10) inclusive.

Ground cooling – procedure

CAUTION

Do not operate the amplifier unit with the ground handling trolley attached until the following are completed.

24.

- (1) Start the Coolanol pump on the trolley, using the system filling procedure described in para.14(11) to 14(13).
- (2) Increase the flow to 18 kg/min using the trolley flow controller.
- (3) The R.F. amplifier may now be safely operated.

Shut down – procedure

25.

- (1) Switch off the R.F. amplifier and reduce the flow to 10 to 12 kg/min using the trolley flow controller.
- (2) Select the pump switch to OFF and IMMEDIATELY disconnect the GREEN RETURN HOSE connection FROM THE AIRCRAFT.
- (3) Set the correct level of Coolanol in the aircraft system using the procedure described in para.17.

◀ **Reservoir sealing check**

26.

Upon filling the system and subsequent checks, the sealing integrity of the reservoir must be observed as follows:-

Wipe the reservoir casing in the area immediately around the vent hole.

Check for signs of Coolanol at the vent hole. An observed drip rate of 1 drip in 5 minutes is acceptable. If the drip rate exceeds this limit then the reservoir must be changed. ▶

Coolanol system faulty components – procedure

◀ 27.

Note . . .

The following procedure must be followed when removing any part of the aircraft Coolanol system for fault rectification, unless it is certain that removal of the part will not involve any leakage of Coolanol.

- (1) Disconnect the amplifier from the aircraft Coolanol system.
- (2) Drain the aircraft system in accordance with the procedure described in para.21 and 22 inclusive.

▶ (3) Remove, rectify or replace any faulty components in the system.

(4) Complete the full test procedure on the system as described in para.8 to 20 inclusive.

CAUTION

Do not reconnect the amplifier to the system until this procedure is completed.

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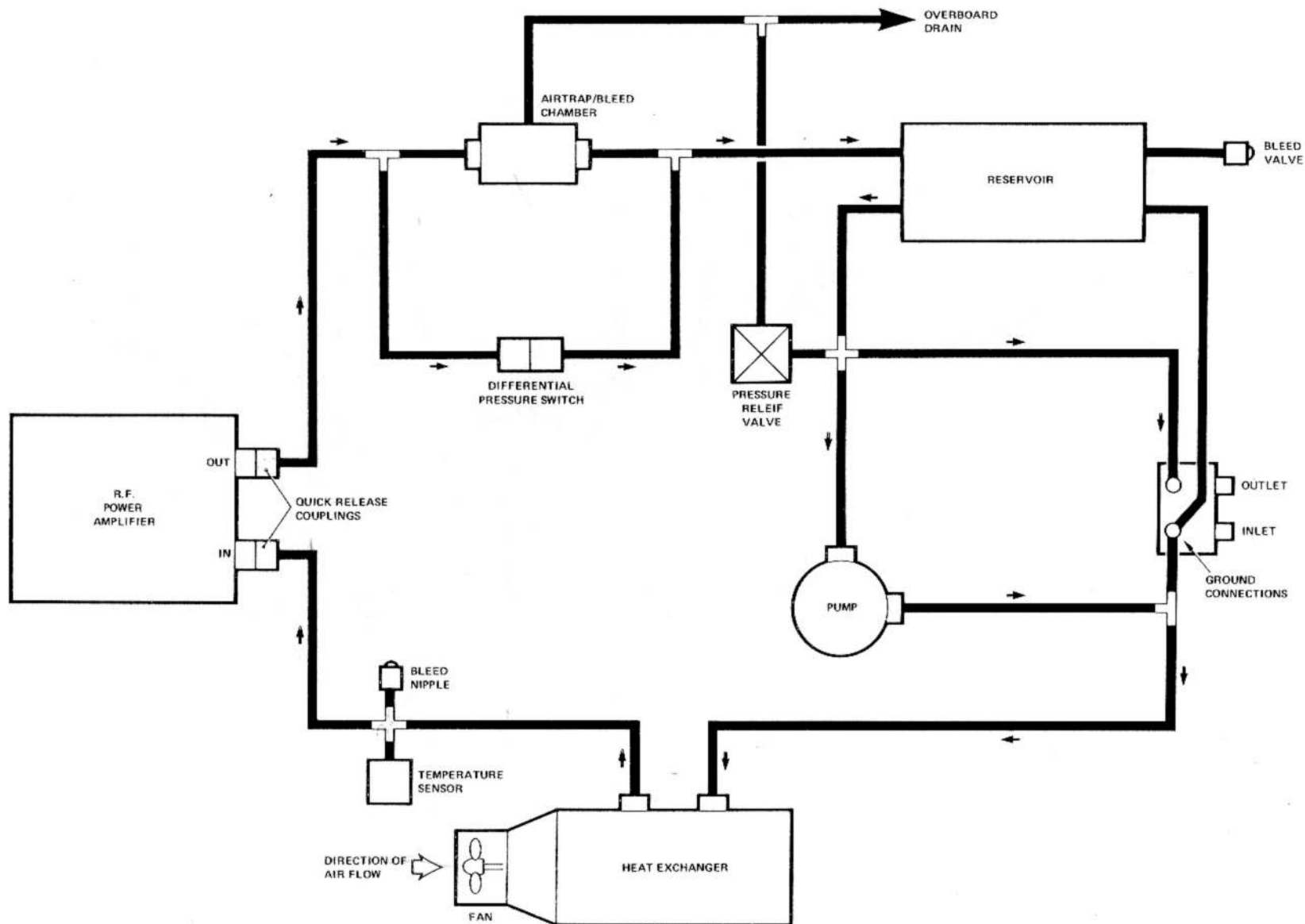
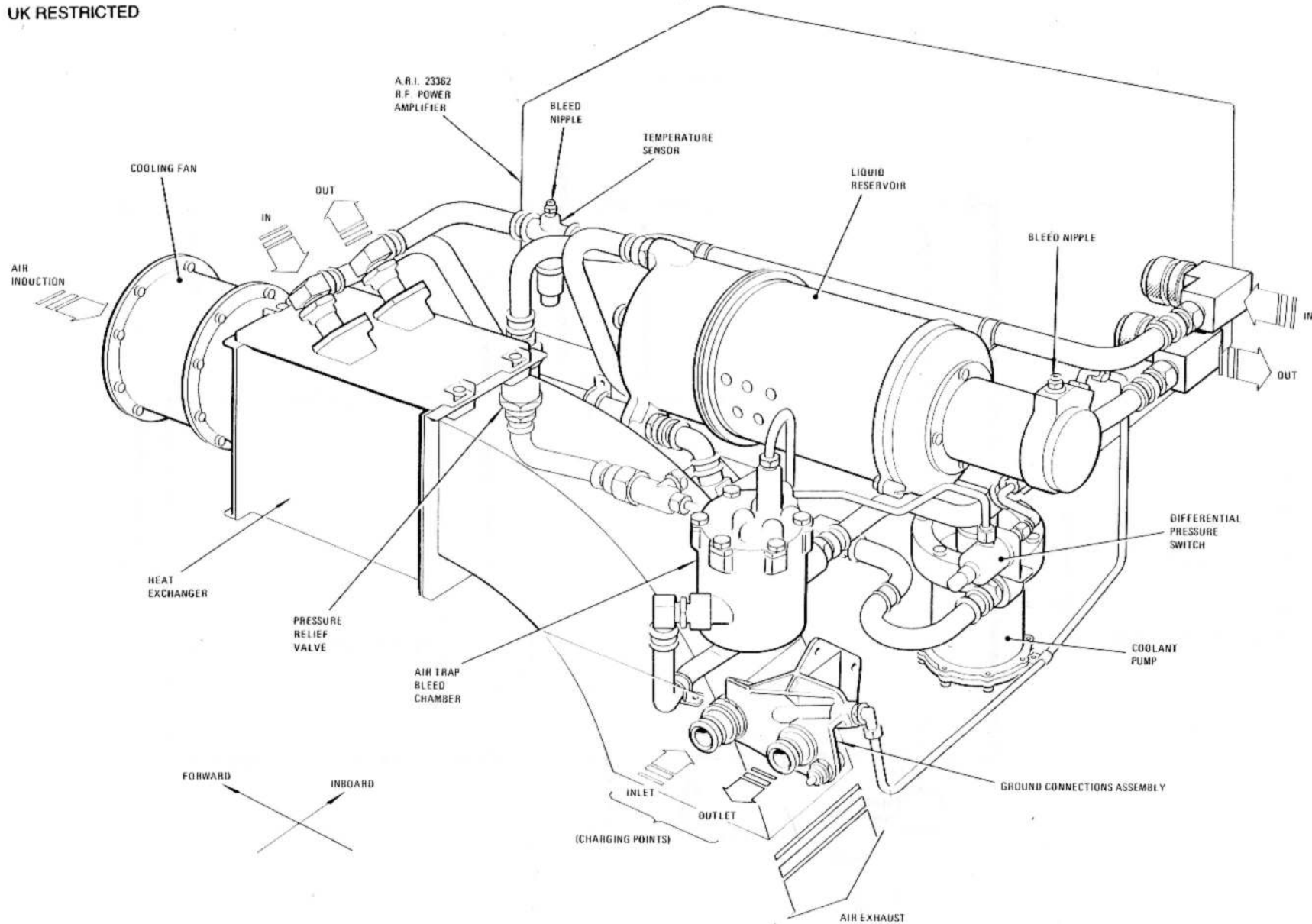


FIG. 3 DIAGRAMMATIC LAYOUT OF LIQUID COOLING SYSTEM



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EG 7 77 5001 SH 3 ISS 2

FIG. 4. COOLANOL COOLING SYSTEM.

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AMBIENT TEMPERATURE DEG C

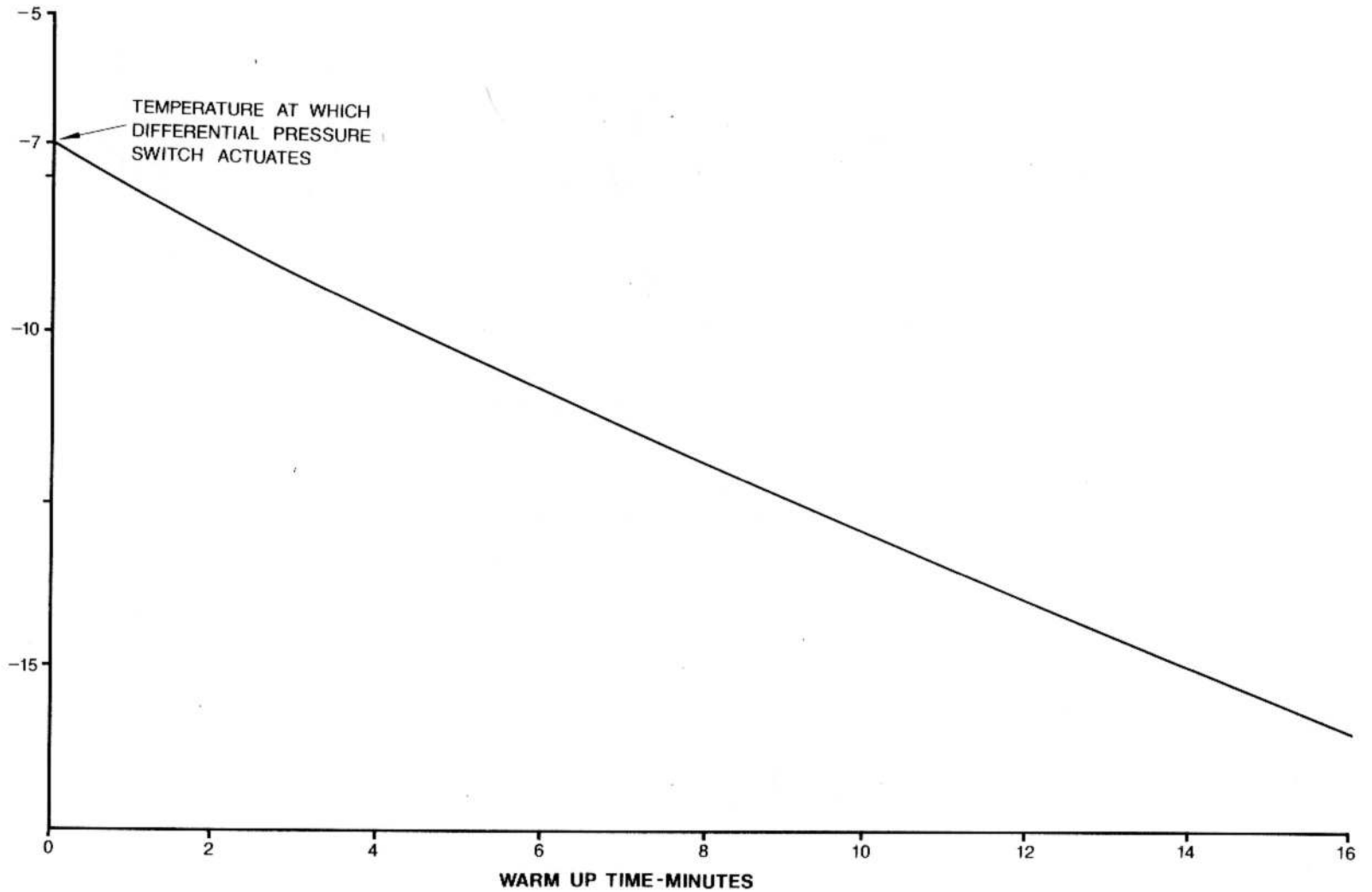


FIG.5 COOLANOL WARM UP TIME

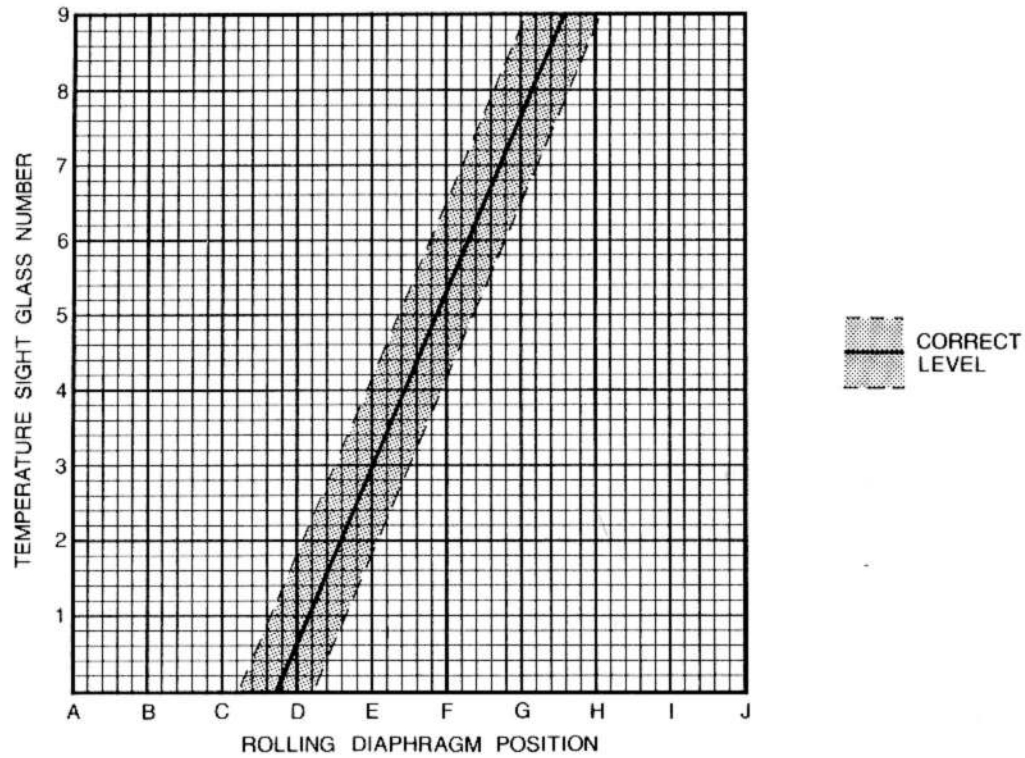
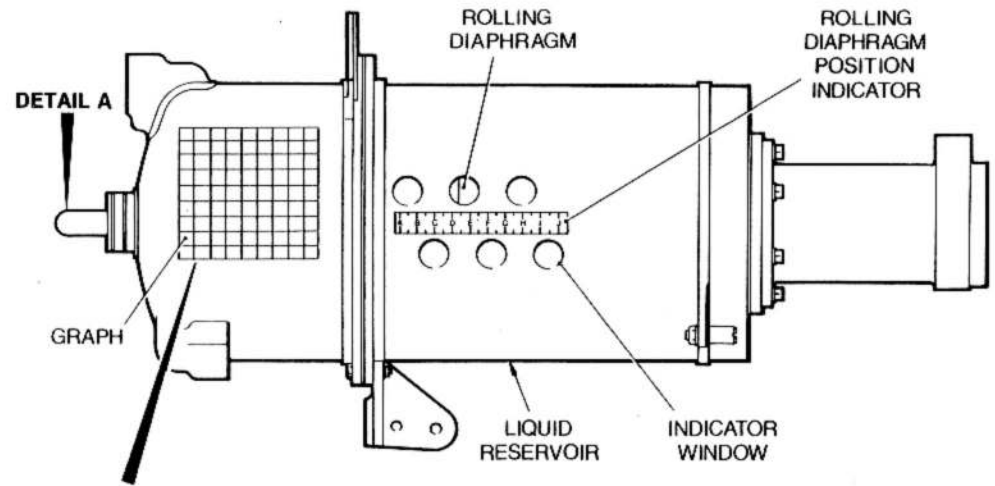
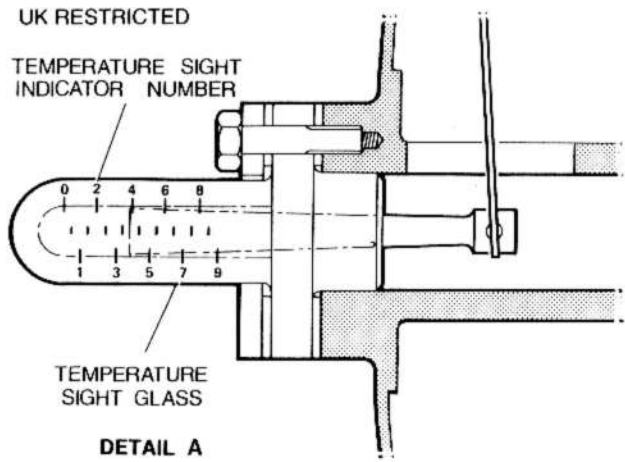
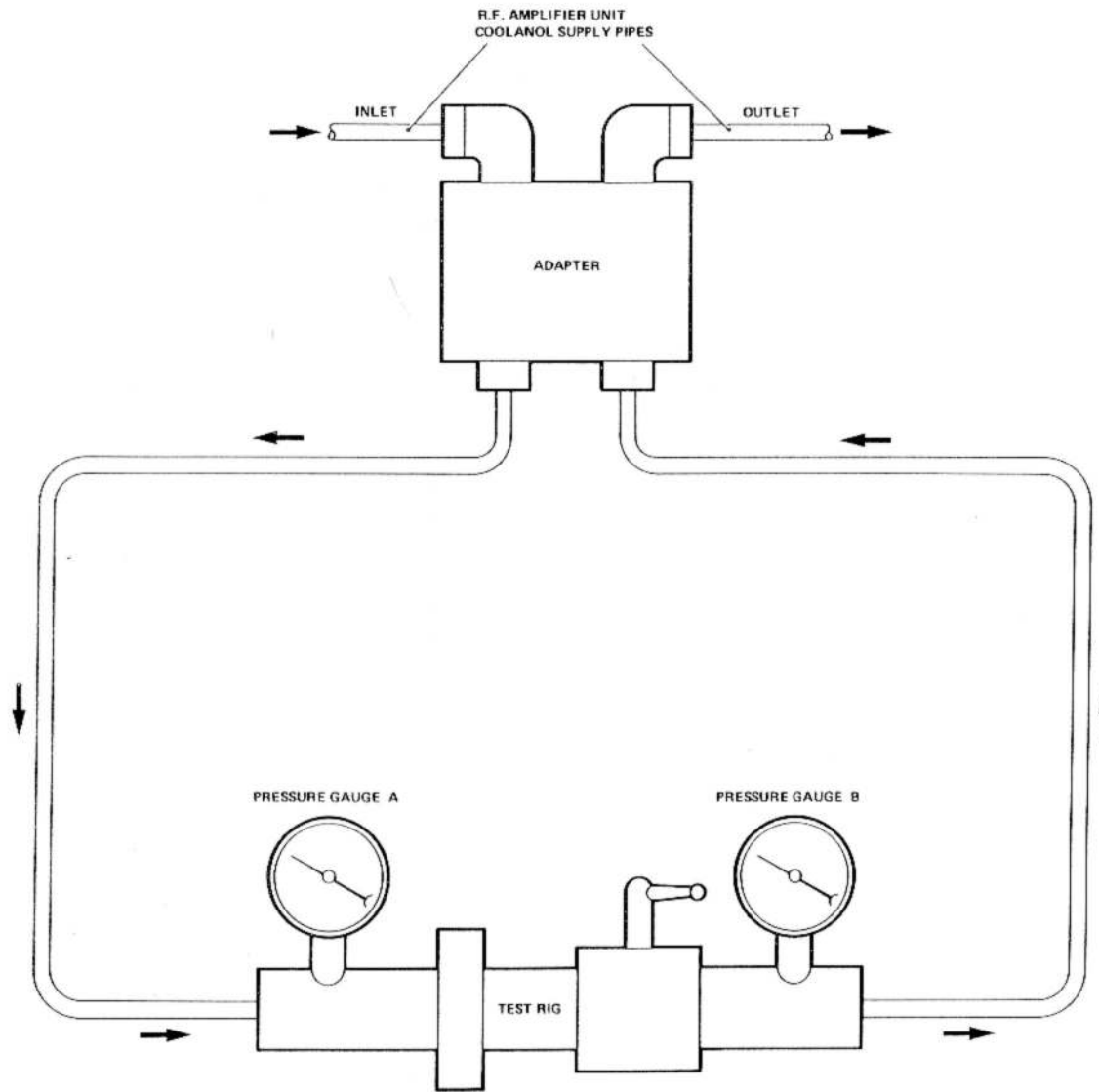


FIG 6 LIQUID COOLING SYSTEM CONTENTS CHECK
◀ (GRAPH AND DETAIL A AMENDED) ▶

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NOTE . . .
GAUGE 'A' SHOULD READ 150Kpa ± 5Kpa HIGHER THAN GAUGE 'B'.

FIG.7 COOLANOL CIRCUIT TEST RIG

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TABLE 1

Coolanol Equipment Major Components

Min. Ref.	Component	Part Number	Type Ref.	A.P. Reference
	Fan	A0571	55	
	Pump	568-8-25235-002		
	Connections assembly	HTE 8459		
	Reservoir	BO1A301Z88-A		
	Pressure relief valve	N-RAV-134-040		
	Differential pressure switch	HE 12769-1		
	Airtrap/Bleed chamber	754-1-36633-001		
	Temperature sensor	HE 60040-1		
	Heat exchanger	03620-70A		

Chapter 9 NITROGEN SYSTEM

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General information

1. As a corrosion preventive, nitrogen is used for pressurizing the waveguides and coaxial cables of the electronic equipment installation (A.P.101B-0417-1B, Sect.9, Chap.4). The nitrogen is stored in two 750-litre cylinders mounted on the floor at the starboard side of the upper equipment compartment. Each cylinder incorporates a five-way connector containing two non-return valves. The cylinders are charged through a valve mounted on a charging panel in the port lower equipment compartment. Details of the nitrogen charging equipment are given in A.P.2306U, Vol.1 and 6, Sect.4. Schrader-type purging valves are provided in each of the waveguide and coaxial cable pressurization lines. A list of principle components is given in Table 1.

DESCRIPTION**Supply system***Charging line*

2. Connected into the charging line between the valve and the cylinders is a relief valve set at 2000 lbf/in². The valve is bracket-mounted on frame 12 at the aft lower end of the main equipment compartment. In addition to four non-return valves incorporated in the cylinder heads, a non-return valve at the upstream connection safeguards the cylinders against total loss of nitrogen due to fracture of the supply line or a defective charging valve.

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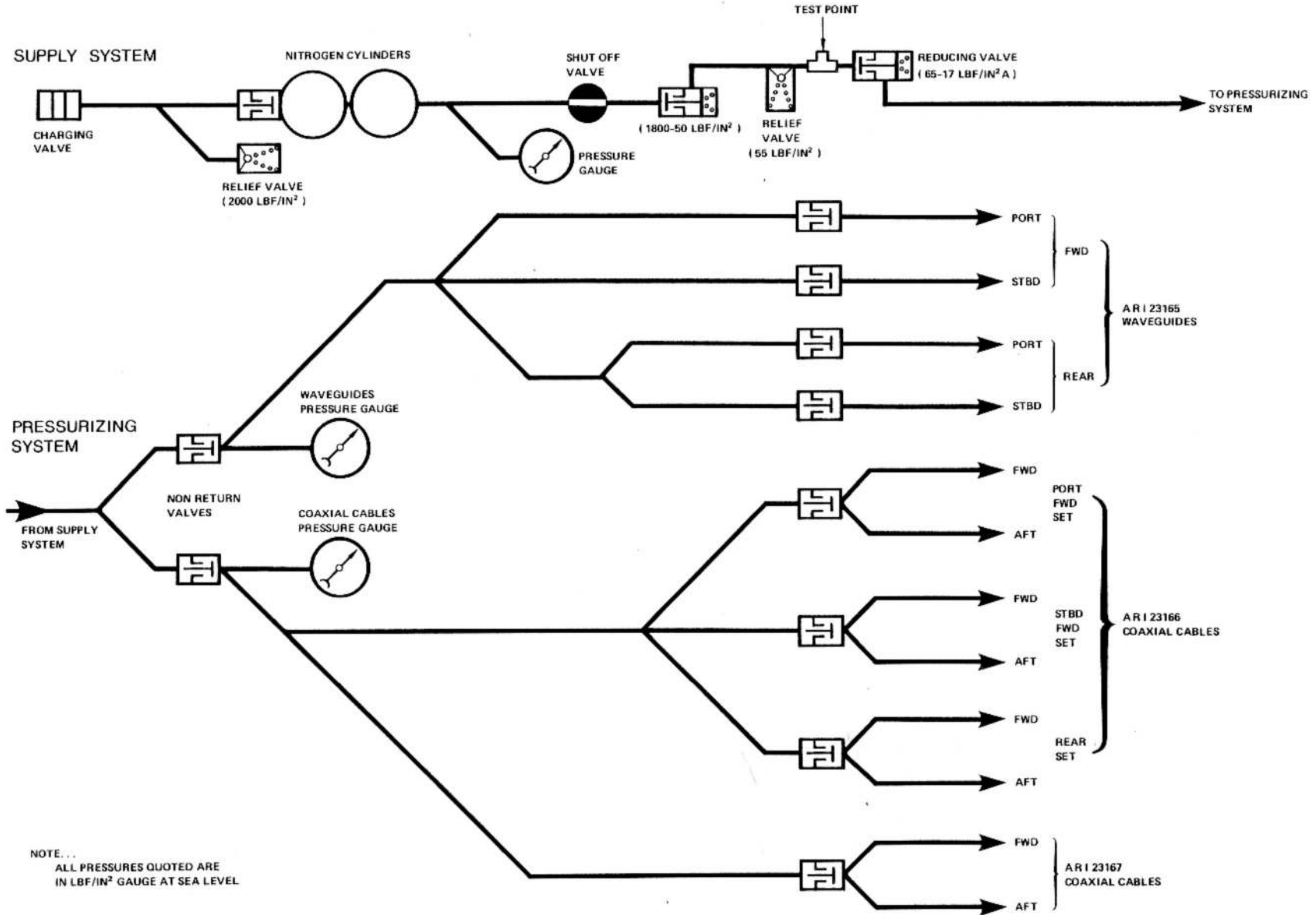


FIG.1 NITROGEN SYSTEM FLOW DIAGRAM (PRE MOD 5466)

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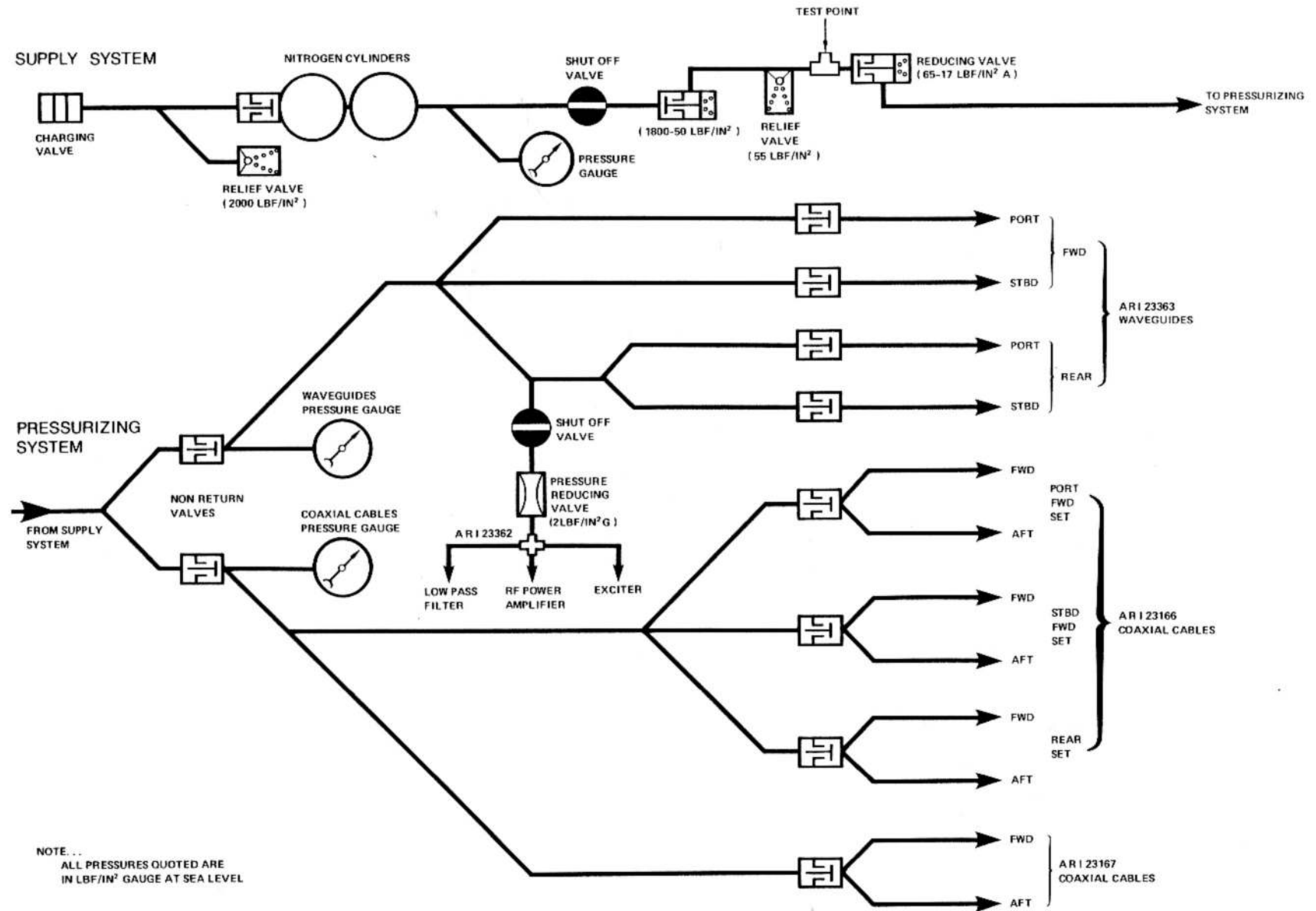
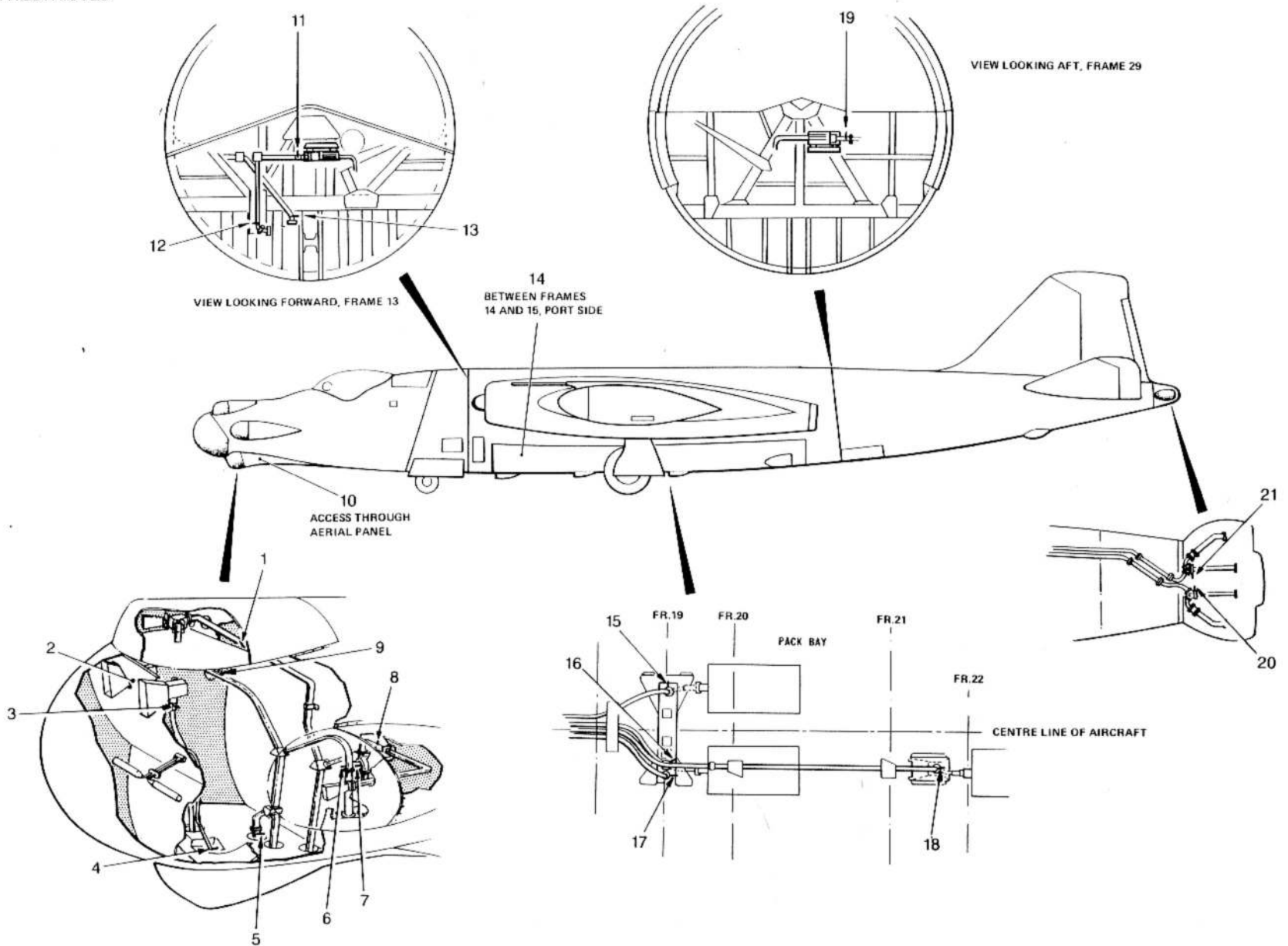


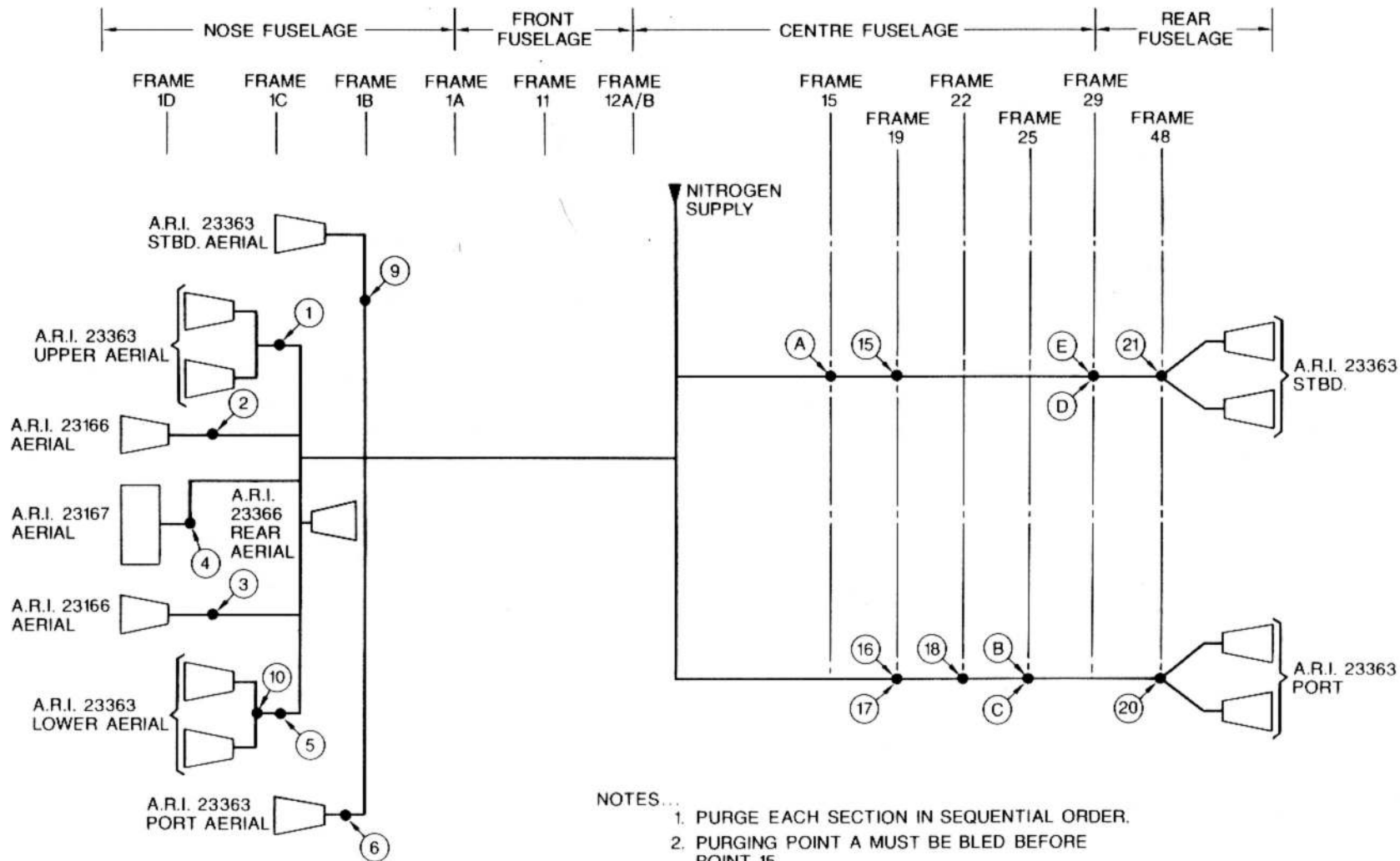
FIG.1A NITROGEN SYSTEM FLOW DIAGRAM (POST MOD 5466)



◀ FIG. 2 LOCATION OF PURGING POINTS (PRE MOD 5466) ▶

◀ ITEM DELETED ▶

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NOTES...

1. PURGE EACH SECTION IN SEQUENTIAL ORDER.
2. PURGING POINT A MUST BE BLED BEFORE POINT 15.
3. PURGING POINTS B, C, D, E, MUST BE BLED IN SEQUENCE BEFORE PURGING POINTS 20 AND 21.
4. PURGING POINTS 7, 8, 11, 12, 13, 14, 19 ARE DELETED.

◀ FIG.3 LOCATION OF PURGING POINTS (POST MOD.5466) ▶

Charging panel

3. The charging valve, a 0-2000 lbf/in² gauge showing main system pressure, and two 0-50 lbf/in² gauges showing the pressure in the waveguides and coaxial cables respectively, are grouped together on the charging panel (*Sect.2, Chap.2*). Mounted above the gauges on the panel are a manually-operated shut-off valve, a 1800-50 lbf/in² reducing valve, a relief valve set at 55 lbf/in² and a 65-17 lbf/in² A reducing valve, all series-connected in the order given. The shut-off valve, normally wire-locked in the open position, is used to regulate the nitrogen flow when charging an empty system and for isolating the cylinders when replacing a component downstream of the valve. The 65-17 lbf/in² A reducing valve incorporates an integral relief valve to avoid over-pressurization of waveguides and coaxial system.

Pressurizing system*Gauges*

4. The supply system is divided into waveguide and coaxial cable systems at a three-way connector just below the charging panel; two additional three-way connectors, each incorporating a non-return valve on the upstream side, connect the individual systems to the associated pressure gauges.

◀ *Waveguide supply (pre Mod.5466) (fig.1)*

5. A four-way connector aft of the charging panel divides the waveguide pressurizing line into port and starboard front, and rear, waveguide supply pipes. The front supply pipes are connected directly into the waveguides immediately aft of the frame. The supply pipe to the rear waveguides runs aft through the electronic equipment bay, to the forward face of frame 29 where it is divided to connect into the rear waveguides. Each of the four connecting lines incorporates a non-return valve.

Waveguide supply (post Mod.5466) (fig.1A)

6. On aircraft incorporating Mod.5466 a branch is taken from the supply pipe, between frames 18 and 19, to a shut-off valve on the forward face of frame 17. Downstream of the valve, between frames 18 and 19, a pressure reducing valve is installed and a four way connector divides the supply between the ARI23362/0 power amplifier, exciter unit and low pass filter. ▶

Coaxial cable supply

7. The supply pipe for the pressurization of the coaxial cables passes through frame 12 and is divided by a three-way connector into the

ARI23166 and 23167 supplies. A four-way connector divides the ARI23166 supply into three for the port forward, starboard forward and rear sets. Each of the four supplies is then divided by a three-way connector which incorporates a non-return valve on the upstream side. All the connectors and supply pipes are situated on the aft face of frame 12.

SERVICING**WARNING**

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

General information

8. Servicing consists of keeping the installation clean, checking that the cylinders are charged, and testing all joints for leaks. Examination of the system should also be made for signs of damage and to ensure that components are securely mounted.

Charging the system

9. The system pressure is checked before flight on the NITROGEN PRESS gauge mounted on the charging panel and the cylinders charged if the indicated pressure is below 1500 lbf/in².

Note . . .

When the aircraft is not required for flight, the system pressure must be checked daily and maintained at above 600 lbf/in².

To charge the cylinders:—

- (1) If the system is empty, close the shut-off valve on the charging panel.
- (2) Remove the blanking cap from the charging valve.
- (3) Connect a high-pressure nitrogen supply from a charging trolley and charge the cylinders with dry nitrogen (*A.P.2306U, Vol.1, Sect.4*) to 1800 lbf/in².
- (4) When charging is completed, disconnect the trolley and refit the charging valve blanking cap.

- (5) If the system has been charged from empty, open the shut-off valve and wirelock.

CAUTION

The valve must be opened gradually so that the rate of pressurizing the waveguides and coaxial cables (as shown on the associated gauges) does not exceed 1 lbf/in² per second.

System leakage test

10. To test the system for leaks:—

- (1) Ensure that there is between 1500 and 1800 lbf/in² pressure available in the nitrogen cylinders.
- (2) Check that the shut-off valve is in the open position.
- (3) Using a solution of water and Teepol (*Ref. No.33C/1129*) to A.P.1275G, Vol.2, Leaflet A4, check all pipe joints and components for leaks.
- (4) Upon completion of the test, remove all traces of the Teepol solution.
- (5) Recharge the system, as necessary, with dry nitrogen (*para.8*).

System purging

CAUTION

The operator must keep his face out of the path of the nitrogen gas expelled from the valves.

11. Whenever the system has been disturbed, e.g. by the removal and installation of a component, air will have been introduced into the system and purging will be necessary. To purge the system:—

- ◀ (1) Refer to fig.2 or fig.3 and to Sect.2, Chap.4, and remove the panels necessary to gain access to the purging points.
- (2) Ensure that the system is charged to 1800 lbf/in² with dry nitrogen and that the shut-off valve is OPEN. ▶

- ◀ (3) Remove the dust cap and open each purging valve in turn (the order is given in fig.2 or fig.3 and the associated number or letter is painted adjacent to each valve) for 20 seconds. Check that gas is being expelled from each valve.
- (4) Repeat (3) after an interval of 5 minutes.
- (5) CLOSE the shut-off valve.
- (6) Refit the valve dust caps and the access panels.
- (7) Recharge the system to 1800 lbf/in² with dry nitrogen (*para.8*).
- (8) Refit the access panels. ▶

REMOVAL AND INSTALLATION

Nitrogen cylinders

12. To remove a cylinder:—

- (1) Open the upper equipment compartment hatch.
- (2) Close the shut-off valve on the charging panel.
- (3) Unscrew the downstream union on the shut-off valve, slowly open the valve and allow the nitrogen to escape. Tighten the union.
- (4) Disconnect the cylinder pipelines and blank off the exposed pipe-ends.
- (5) Break the locking wire and release the two cylinder-retaining straps by unscrewing the turnbuckles.
- (6) Remove the cylinder from the compartment. ▶

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TABLE 1

List of principal components

Ref. No.	Description	Quantity
6D/2858	Charging valve, A190 Mk.2 (pre Mod.5466) (post Mod.5466)	1 2
27VB/5954	Relief valve, RV.18 Mk.8	1
6D/9429891	Nitrogen cylinder, 750-litre, Mk.5D	2
6A/2689	Pressure gauge, Mk.14H	1
6D/2118	Nitrogen valve, Type BNA.3	1
27VB/6275	Pressure-reducing valve, PAS.220-007	1
	Relief valve, RAV.131-015	1
	Pressure-reducing valve, ACM.24950	1
6D/427	Non-return valve, Mk.1	11
6A/2721	Pressure gauge, Mk.14Q	2
TBA	Pressure reducing valve (post Mod.5466)	1

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Chapter 10 OXYGEN SYSTEM

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REMOVAL AND ASSEMBLY

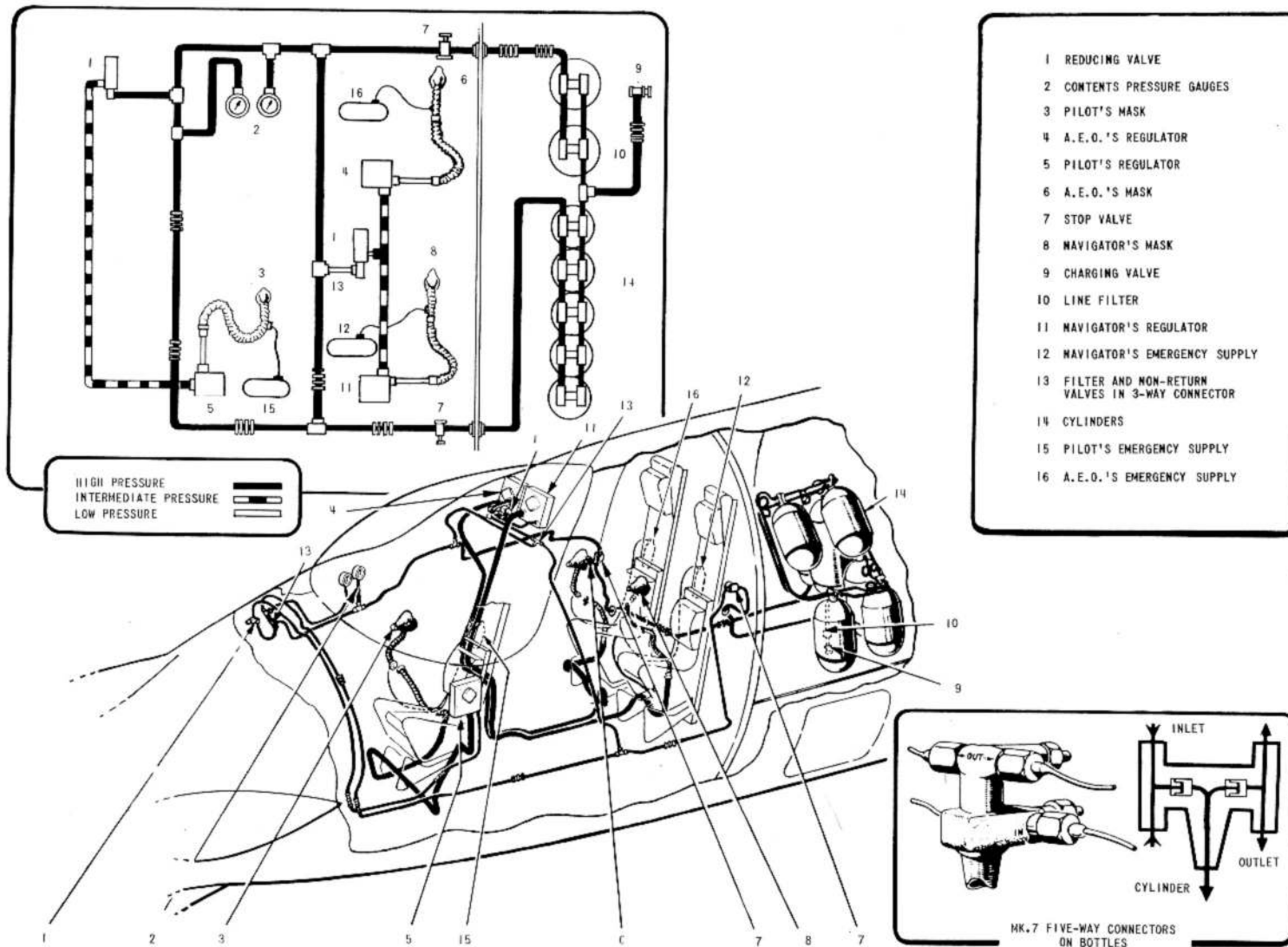
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- 1 REDUCING VALVE
- 2 CONTENTS PRESSURE GAUGES
- 3 PILOT'S MASK
- 4 A.E.O.'S REGULATOR
- 5 PILOT'S REGULATOR
- 6 A.E.O.'S MASK
- 7 STOP VALVE
- 8 NAVIGATOR'S MASK
- 9 CHARGING VALVE
- 10 LINE FILTER
- 11 NAVIGATOR'S REGULATOR
- 12 NAVIGATOR'S EMERGENCY SUPPLY
- 13 FILTER AND NON-RETURN VALVES IN 3-WAY CONNECTOR
- 14 CYLINDERS
- 15 PILOT'S EMERGENCY SUPPLY
- 16 A.E.O.'S EMERGENCY SUPPLY

FIG. 1. OXYGEN SYSTEM

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Introduction

1. This chapter contains a description, together with the servicing procedure and the method of removal and assembly of some of the components, of the oxygen system. The electrical services associated with the oxygen regulators are described in A.P.101B-0417-1B, Sect.6, Chap.12, and brief details of the regulators and pressure gauges are given in A.P.101B-0417-1B, Sect.7, Chap.3. A full description of the system components, the procedure for servicing them, and the method of charging the cylinders, are given in A.P.107D and 108 F series.

List of principal components

2. Refer to Table 1.

DESCRIPTION**General information (fig.1)**

3. Oxygen is carried in seven cylinders (two 2250 litres and five 750 litres) mounted in the upper equipment bay (Sect.2, Chap.4). Each cylinder has a five-way connection incorporating two non-return valves. To reduce vulnerability, and as a safeguard against total loss of oxygen in the event of fracture of the supply lines, the cylinders are grouped into two banks, isolated from each other, and the high-pressure system is duplicated. A charging valve, located on the aft face of frame 12, enables all the cylinders to be charged in situ.

4. High-pressure supply lines, one to each bank of cylinders, pass forward through the pressure bulkhead to stop valves mounted on the port and starboard

fuselage skin, forward of frame 9. From the stop valves the high-pressure supply lines pass along the walls of the pressure cabin to a point forward of the pilot's instrument panels, where the port supply line passes across the cabin to join the starboard line. The supply lines are joined by a three-way connector housing a non-return valve in each of the connections to the supply

lines, the third being connected to a pipe leading to a pressure-reducing valve. Two pressure gauges, located on the miscellaneous instrument panel, are connected into the supply lines, to register the pressure in each bank of cylinders. From the pressure-reducing valve, which reduces the pressure to between 250 and 400 lb/in², an intermediate-pressure supply line is connected

TABLE 1**List of principal components**

Ref. No.	Description	No.off per A/C
6D/9429900	Oxygen cylinder, 2250 litres	2
6D/9429896	Oxygen cylinder, 750 litres	5
6D/2344	Pressure-reducing valve, Mk.1A	2
6D/1650	Flange L.P. hose connector	3
6D/2237	Oxygen contents gauge, Mk.4	2
6D/427	Non-return valve, Mk.1	4
6D/1652	Quick-release socket, Mk.9	3
6D/2294	Oxygen regulator, Mk.17E	3
or		
6D/2671	Oxygen regulator, Mk.17F	3
6D/574	Filter unit	1
6D/575	Connection, 2-way	8
6D/603	Connection, 3-way, Mk.3A	7
6D/1698	Aeroflex clip, Type D	3
6D/1579	Flexible tubing, 4 ft	3
6D/1497	Union blank, Mk.3	5
6D/2678	Emergency oxygen set Mk.7J (Type 2CA1 and Type 2CA2 ejection seats)	3
6D/2185	Upper oxygen tube assembly	3
6D/2055	Cable-operating socket anchor	3
6D/1464	Socket anchor, outer housing	3
6D/2244774	Charging valve, Type 1	1
6D/2244775	Stop valve, Type 1	2

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to the pilot's pressure-regulator mounted on the port wall of the cabin above the console.

5. A pipeline, passing across the cabin at the navigator's and A.E.O. stations, joins the two supply lines on the port and starboard walls, respectively. At the navigator's position, a three-way connector, housing two non-return valves and a filter, joins a pipeline to a reducing valve which, through intermediate pressure branch pipelines, supplies the navigator's and A.E.O. pressure-regulators mounted on the canopy coaming cross-tube.

Note...

A label is fitted adjacent to the navigator's stop valve, stating that the valve must be left open.

Pilot's supply

6. From the pilot's pressure-regulator a low-pressure pipe, terminating in a flanged connector, takes the supply to an attachment point on the starboard side of the ejection seat. The flexible tube from the pilot's face mask is connected to a break point on the connector so that it will disengage when the seat is ejected.

Navigator's supply

7. From the navigator's pressure-regulator the supply is conveyed by a low-pressure pipe terminating in a quick-release socket. The navigator's face mask is connected to the socket and will disengage when the seat is ejected.

A.E.O. supply

8. From the A.E.O. pressure-regulator the supply is conveyed by a low-pressure line to a flanged connector and a quick-

release socket. The A.E.O. face mask is connected to the socket and will disengage when the seat is ejected.

Emergency oxygen

9. Each crew member is equipped with an emergency oxygen set for use when a failure occurs in the main oxygen system, or when he abandons the aircraft by operating his ejection seat. The emergency oxygen cylinders are clamped on the starboard side of each ejection seat, and are individually coupled to the main supply tubes at the quick-release sockets by the upper oxygen tube assemblies. Emergency oxygen is made available automatically on ejection, or manually by operating the Bowden release cable situated on the starboard side of each ejection seat.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

Oil and grease combine explosively with undiluted oxygen. To prevent injury to personnel or equipment, do not use these materials on or near the oxygen system.

General information

10. The servicing necessary to maintain the system in an efficient working condition consists of keeping the installation free from oil, grease and moisture, checking that the cylinders are always fully charged, and testing joints for

leaks. Examination of the system should be made for signs of damage and to ensure that components are securely mounted. Check that the flexible tubes are securely fitted and that at the pilot's station, the flexible tube is fully down to the flange at the ejector seat break-point. The standard serviceability and operational tests of the components are described in 107D and 108F series.

Charging the cylinders

11. Scrupulous cleanliness of all connections must be observed during charging operations. To charge the cylinders:-

(1) Remove the blanking cap from the charging valve on the aft face of frame 12 bulkhead.

(2) Using oxygen-charging trolley Ref. No. 4G/4220, in accordance with A.P.101B-0001-1, charge the cylinders to 2000/lb in²; upon cooling, the pressure will fall to approximately 1800 lb/in².

(3) When charging is completed, disconnect the charging trolley and refit the blanking cap on the charging valve.

System leakage test

12. To test the system for leaks:-

(1) Remove the locking wire, and switch the three oxygen regulator ON/OFF valves to OFF.

(2) Ensure there is between 1700 lb/in² and 1800 lb/in² pressure in the oxygen cylinders.

(3) Check that the stop valves are OPEN.

(4) Check all pipelines and components

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for leaks, using a suitable solution (A.P.107D-0402-1, Chap.3-1).

Note. . .

If a leak is found it is generally caused by dirt on the nipple or branch mating face; this is remedied by cleaning and degreasing the faulty fitting. If the leak persists renew the fitting.

(5) Upon completion of the tests remove all traces of the solution.

(6) Return the three regulator ON/OFF valves to ON and wire-lock, using 28 s.w.g. enamelled copper wire, Ref. No.5E/9102399.

System functioning test

13. To test the functioning of the system and system components:-

(1) Ensure there is between 1700 lb/in² and 1800 lb/in² pressure in the cylinders.

(2) Remove the locking wire, and close the port and starboard line stop valves.

(3) Exhaust the cabin side of the system by depressing the valve in the free end of the pilot's flexible hose connection and operating the regulator MASK TEST switch.

(4) Open the port line stop valve. Pressure should read rapidly on forward contents gauge.

Note. . .

The rear contents gauge will record slowly due to leak past non-return valve in the starboard supply line.

(5) Close the port line stop valve.

(6) Exhaust the cabin side of the system as at operation (3).

(7) Open the starboard line stop valve. Pressure should read rapidly on the rear contents gauge.

Note. . .

The forward contents gauge will record slowly due to leak past the non-return valve in the port supply line.

(8) Open the port line stop valve.

(9) Ensure that the flexible hose is down to the flange at the ejection seat breakpoint.

Make the following checks at all three oxygen regulators.

(10) Pressure reducing valve check - check that each regulator pressure gauge reads between 200 lb/in² and 400 lb/in².

Note. . .

If the pressure at the regulator is greater or less, the pressure-reducing valve is suspect, and must be tested, as detailed in A.P.107D-0201-1.

(11) Regulator internal leakage check - remove the locking wire, and switch the regulator ON/OFF valve to OFF and check the pressure drop on the regulator gauge. This must not exceed 25 lb/in² in 60 seconds. Switch the regulator ON.

(12) Low pressure pipe check - set the air inlet shutter to NORMAL, insert the rubber stopper in the mask socket connection, switch the emergency toggle to left or right and turn off the regulator ON/OFF valve. Check the time taken for the regulator

pressure to drop to zero; this must be not less than 60 seconds.

(13) Air inlet shutter check - switch the air inlet shutter on the oxygen regulator to 100% OXYGEN and, with the regulator ON/OFF valve OFF, suck gently through the face mask. There should be a considerable resistance to suction. Whilst still sucking move the air inlet shutter to NORMAL; there should be no resistance to suction.

(14) Using a face mask, make the following checks at each crew position:-

(a) Breathing normally with the regulator switch ON and the air inlet shutter at NORMAL, check that with each inhalation the blinker indicator on the regulator face operates.

(b) Deflect the EMERGENCY toggle switch to the left and to the right and check that there is a continuous flow of oxygen. With the toggle switch in the central position, push the toggle switch downwards and verify that there is a continuous flow of oxygen at a much increased pressure. Insert a rubber stopper in the mask socket connection and, with the toggle switch in each position, i.e. left, right and centre, check that the flow ceases and the blinker indicator returns to normal.

(15) Upon satisfactory completion of these tests wire-lock the high-pressure line stop valves in the fully OPEN position. Wire-lock the regulators ON/OFF valves in the ON position using, 28 s.w.g. enamelled copper wire, Ref. No.5E/9102399.

Emergency oxygen control lever

14. The pull off load for the emergency oxygen control lever must not exceed 30 lb.

Lubrication

15. Refer to the WARNING preceding para.10. The authorized lubricant for use on the screw threads of the oxygen equipment is graphited lubricating fluid, ZX-32. No other lubricant may be used. Instructions for lubrication will be found in A.P.107D-0001-1.

REMOVAL AND ASSEMBLY

Oxygen cylinders

16. To remove an oxygen cylinder:-

- (1) Open the upper equipment bay hatch (*Sect.2, Chap.4*).
- (2) Remove the locking wire from the high-pressure stop valve in the supply line from the associated bank of cylinders, and fully close the valve.
- (3) Unscrew the stop valve forward union, slowly open the stop valve, and allow the oxygen to escape.

- (4) Disconnect the cylinder pipelines and blank off the exposed pipe-ends.
- (5) Release the two cylinder-retaining straps by unscrewing the two turnbuckles
- (6) Remove the cylinder from the compartment

Oxygen regulators

Removal

17.

- (1) Disconnect all electrical supplies.
- (2) Disconnect the electrical plug from its socket.
- (3) Remove the locking wire from the associated high-pressure stop valve and fully close the valve.
- (4) Uncouple, remove and blank off the oxygen supply and delivery pipes.
- (5) Remove the four 2 B.A. securing screws and remove the regulator.

◀ **Note:**

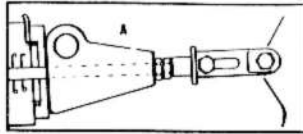
After removal of the post mod 3225 regulator, the protective guard must be removed and attached to the replacement regulator prior to its installation. ▶

Assembly

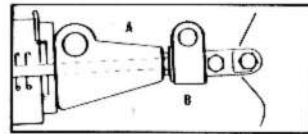
18.

- (1) Position the regulator in its bracket and secure with the four 2 B.A. screws.
- (2) Reconnect the oxygen supply and delivery pipes.
- (3) Reconnect the electrical plug and socket.
- (4) Reconnect the electrical supplies
- (5) Turn the stop valve to the fully-open position and wire-lock.
- (6) Function-test the regulator and system (*para.13*).
- (7) Carry out an electrical test (*A.P.101B-0417-1B, Sect.6, Chap.12*).

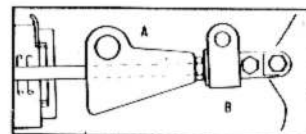
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1 PULL BACK THE CONTROL COLUMN AND INSERT DISTANCE PIECE A

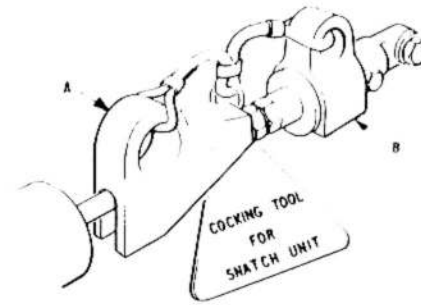


2 EASE THE CONTROL COLUMN FORWARD AND INSERT DISTANCE PIECE B



3 PULL BACK THE CONTROL COLUMN UNTIL THE SEAR ROLLER FALLS INTO PLACE. EASE THE CONTROL COLUMN FORWARD UNTIL THE PISTON ENGAGES THE SEAR ROLLER, REMOVE DISTANCE PIECES A & B

TO COCK SNATCH UNIT



1 MOUNTING BRACKET FOR MICROSWITCH MBCJ-2153. THIS BRACKET HAS BEEN DESIGNED TO ALLOW MICROSWITCH TO BE REMOVED WITHOUT REMOVING OPERATING MECHANISM

2 THIS DIMENSION TO BE MAINTAINED BY ADJUSTMENT OF TAPPET MAJ-2132. IMPORTANT - BEFORE SETTING THIS GAP ENSURE THAT MICROSWITCH OPERATING LEVER IS IN CONTACT WITH BREECH BODY AS SHOWN BELOW

3 CUT-OUT PROVIDED IN GUARD PLATE TO ALLOW CHECKING AND SETTING OF MICROSWITCH GAP

4 STOP FACE PROVIDED ON MICROSWITCH OPERATING LEVER TO ALLOW A DEFINITE GAP TO BE MAINTAINED BETWEEN MICROSWITCH AND TAPPET

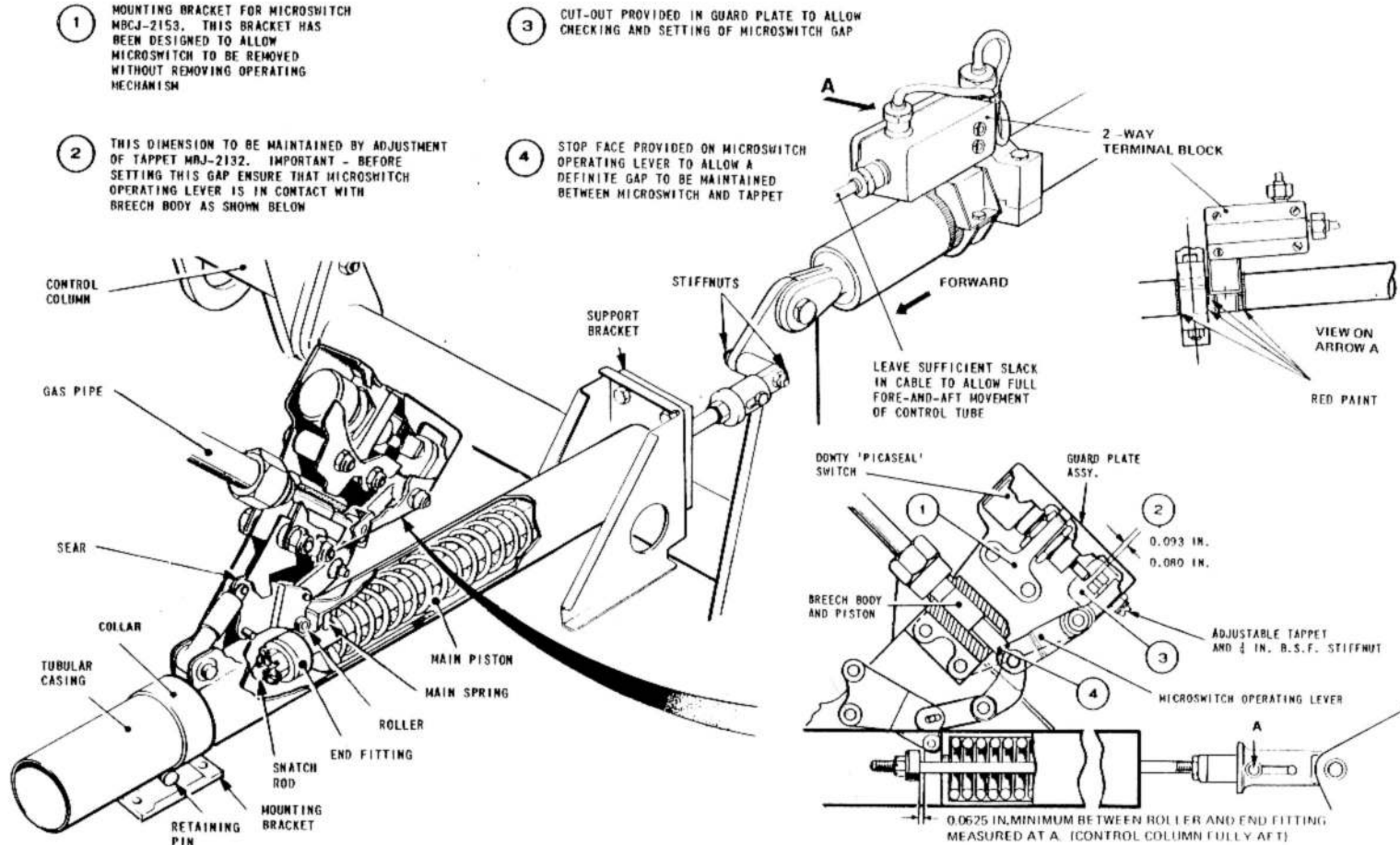


FIG. 1. CONTROL COLUMN SNATCH UNIT

DESCRIPTION

General information

1. The emergency equipment comprises automatic ejection seats for pilot and crew, provision for emergency lowering and raising of the alighting gear, fire detection and extinguishing systems, an aircraft destructor and provisions for jettisoning the entrance door, canopy and crew hatch. Operating instructions are given in Sect.1, Chap.3.

Canopy and hatch

2. The pilot's canopy and the crew's escape hatch are attached to the fuselage by bolts containing detonators; both are jettisonable by operation of the associated jettison switches.

Ejection seats

3. The pilot's is a Type 2CA.1, Mk.2 ejection seat and the crew members are both accommodated in Type 2CA.2, Mk.4 ejection seats. All are equipped with single-lever ejection facilities and are described in A.P.109B-0107-1.

Combined time-release and breech unit

4. This unit provides the power to operate the snatch unit and incorporates a time-delay mechanism which withdraws the sear from the seat ejection-gun approximately one second after the snatch-unit gun has been fired. The snatch-unit gun and the time-delay mechanism are contained in separate compartments within a casing bolted to the rear of the guide rail. At the base of the snatch-unit gun is a threaded union which, together with a soft metal washer, forms a gas-tight connection

with a pipe which communicates with the chamber of the piston valve assembly on the top of the snatch unit. For a description of the combined time-release and breech unit Pt.No.MBSJ/159 refer to A.P.109A-0001-1.

Control column snatch unit (post Mod.4435) (fig.1)

5. This unit is fitted within the pilot's console on the port side of the cockpit and is connected to the elevator control-lever. Its purpose is to move the control column forward and hold it against the instrument panel to provide an unobstructed exit for the pilot in his ejection seat when abandoning the aircraft. An explosive severance-unit, fitted around the elevator control tube aft of the control lever and fired prior to the operation of the snatch unit, severs the elevator control-tube which nullifies the effect that movement of the control column, due to the action of the snatch unit, would otherwise have upon the flying attitude of the aircraft.

6. The unit consists of a tubular casing supported at the rear end by a bracket and attached at the forward end to the aircraft structure by a collar secured to a mounting bracket by a retaining pin and split pin. The tubular casing houses a hollow piston which, when the unit is cocked, holds the mainspring under compression against the closed rear end of the casing. The piston is retained in the cocked position by a sear, the roller of which projects through the wall of the tubular casing; the sear is spring-loaded in

its cocked position by the sear return spring. A snatch-rod passes through the rear-end casing, inside the mainspring and through the drilled head of the hollow piston, to terminate in a shouldered end-fitting carrying a rubber cushion. The outer end of the rod is screwed into a slotted attachment fitting and locked by a locknut; the length of the snatch rod can be adjusted at this point. The end of the slotted attachment fitting is drilled and bushed to fit on to a shouldered stud fitted to the elevator control-lever; the bush is radiused at one end and it is essential that this end faces the shouldered stud. The slot allows free movement of the snatch-rod, and the rod moves freely within the piston, and is of sufficient length to allow full fore-and-aft movement of the control column.

7. The snatch unit and the elevator-control-tube severance-unit detonator switch (which is mounted on a bracket secured to the snatch unit) are controlled by the ejection seat face-screen, or seat-pan, firing handle. When either handle is operated a cartridge is fired in the combined time-release and breech unit (para.4) from which the resultant gas pressure is directed through a pipe to a valve piston assembly mounted on the top of the snatch unit. The valve piston engages a boss at the interconnection of the sear operating lever and the microswitch operating lever. The sear operating lever is pivoted at its centre on the snatch unit and is interlinked at its lower end to the sear; the microswitch operating lever, which is pivoted on the mounting plate, has

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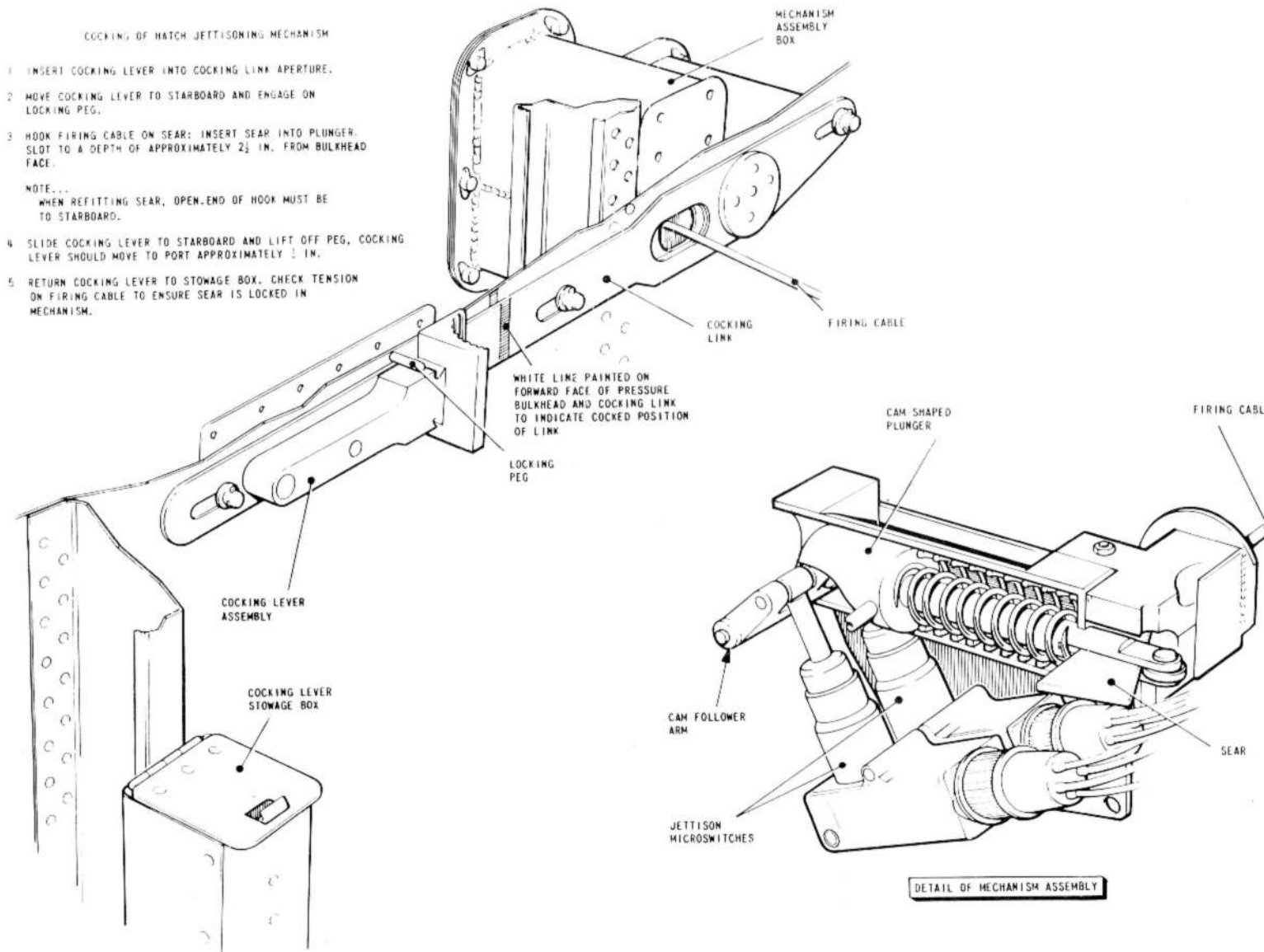


FIG. 2. HATCH JETTISONING MECHANISM

◀ MOD 4468, 4469 INCORPORATED ▶

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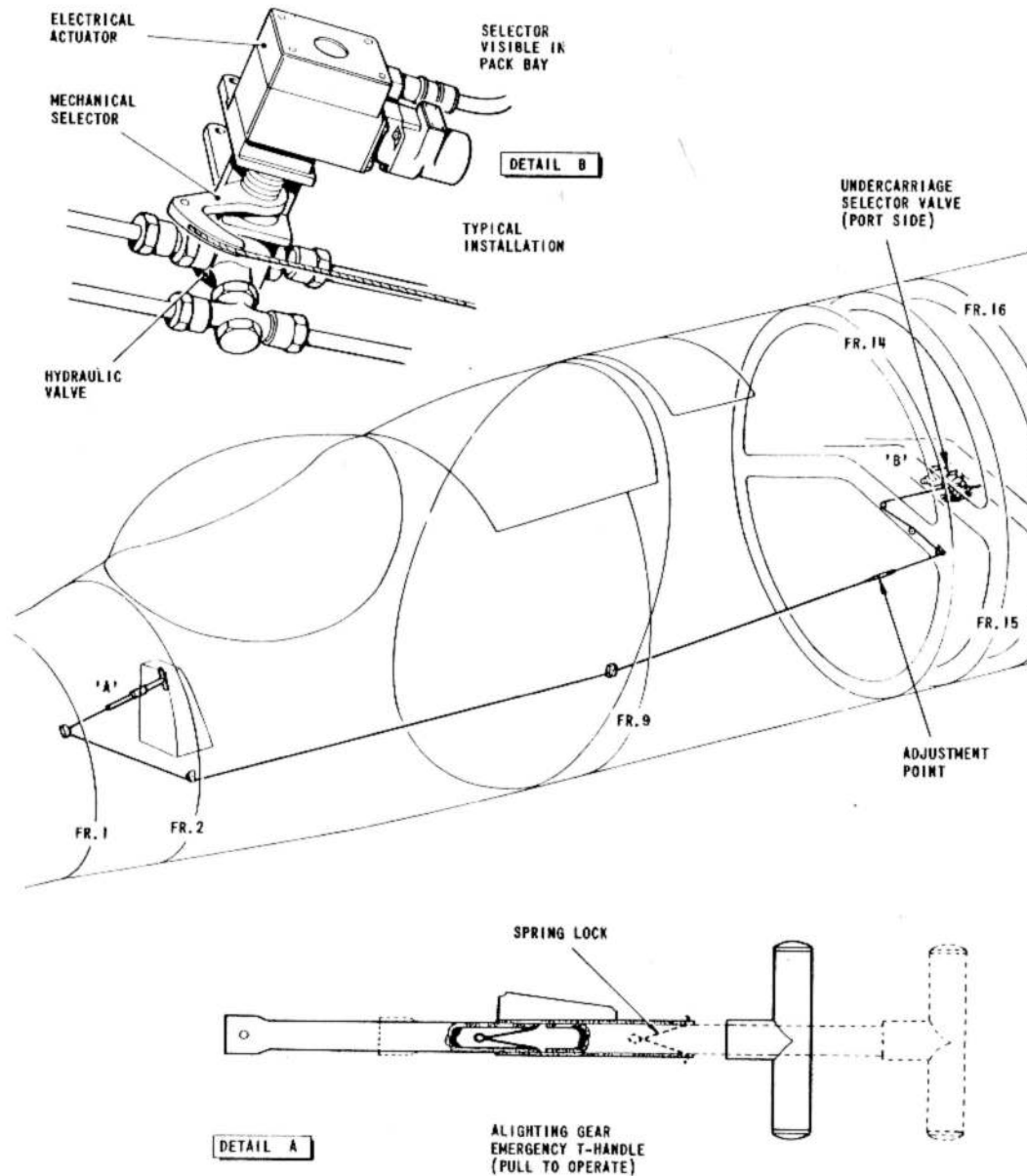


Fig. 3. Alighting-gear emergency lowering control

an adjustable tappet at its switch end and a stop face at the other end, which bears against the breech casing of the valve piston assembly. The gas pressure forces the piston against the boss and rotates both levers, the sear operating lever withdraws the sear and the micro-switch operating lever operates the microswitch, the severance unit being exploded before the snatch unit operates. Operation of the firing handle also trips the release of the combined time-release and breech unit which withdraws the ejection gun sear, after a delay of one second, to initiate seat ejection.

9. The action of releasing the sear frees the hollow piston which, under the force of the mainspring, is propelled along the interior of the casing and contacts the end fitting of the snatch rod; further extension of the spring moves the snatch rod forward and, through the elevator control lever, rotates the elevator torque shaft and moves the control column forward against the instrument panel.

Hatch jettisoning single-lever ejection
9. The single-lever ejection system for the crew members comprise Type 2CA.2, Mk.2 ejection seats and two hatch-jettisoning mechanisms which are secured to the rear face of the pressure bulk-head. The ejection guns of these seats have breech-type time-delayed firing units fitted with a restrictor and safety-catch (A.P. 100A-0001-1), the latter being connected to the hatch by a secondary firing cable. The seat-firing cable is bifurcated, one leg being connected to the ejection gun sear and the other to the sear of the hatch-jettisoning mechanism.

Hatch-jettisoning mechanism boxes

10. These units are mounted on the aft

face of the pressure bulkhead and are positioned behind each crew ejection seat; their purpose is to initiate automatic jettisoning of the hatch prior to ejection of either crew seat. The boxes are sealed to the bulkhead to prevent pressurized air from the cabin escaping to atmosphere via the sear and cocking-lever apertures.

11. Each box houses two microswitches which, when operated, complete the circuit to the hatch detonators, and a tubular casing containing a spring-loaded plunger which is cam-shaped at one end. The plunger, when cocked, holds the mainspring in compression against the closed end of the casing and is retained in that position by a sear which is attached to the seat-firing cable. A cam-follower assembly, comprising three rollers mounted on a pivoted arm, transmits the contours of the cam to the microswitches.

12. When either firing handle of the associated ejection seat is operated, one leg of the bifurcated firing-cable withdraws the sear from the breech-type time-delayed firing unit. Withdrawal of the sear causes the firing pin to rise slightly and its roller is immediately trapped by the restrictor pawl; a safety catch positioned in the restrictor jaws prevents the release of the firing pin. Simultaneously, the other leg of the bifurcated firing cable withdraws the sear from the hatch-jettisoning mechanism and, under the influence of its spring, the cam-face of the plunger forces the cam-follower to operate the microswitches. This completes the circuit to the hatch detonators and the hatch is blown off. As the hatch leaves the aircraft the secondary firing cable withdraws the safety catch from the restrictor of the firing unit and the firing pin is thereby released to fire the ejection gun, which it does after a delay of approximately one second.

Secondary firing cable

13. The upper end of the cable is connected to the hatch by a steel shackle pin and secured by a washer and split pin; the lower end is similarly connected to the safety catch in the breech-type time-delayed firing unit. The purpose of the cable is to withdraw the safety catch from the ejection-gun firing unit as the hatch leaves the aircraft, thereby ensuring correct sequencing of hatch jettisoning and seat ejection.

Alighting-gear emergency lowering control (fig.3)

14. This control is a black-and-yellow striped T-shaped handle situated to port of the instrument-flying panel; it is connected by cable to the alighting-gear selector. The control is locked in the operated position by a wire spring, contained in the shaft of the handle, which hooks over the end of the control housing when the handle is fully extended. For resetting instructions refer to para.25.

15. The control cable passes from the handle over pulleys behind the instrument panel, aft down the port side of the fuselage and into the electronic equipment pack bay where it is connected to a lever on the selector. The lever is spring-loaded to the off position.

Alighting-gear emergency raising control

16. The UP mechanical lock can be overridden in an emergency, or if required during servicing, by turning the knobbed ring which encircles the UP button, clockwise through 60 deg. (or 90 deg. according to type) and then depressing the button in the normal manner. If an UP selection is made this way, the mechanical lock will remain inoperative until reset. To reset, lightly depress the DOWN selector button and hold depressed. Insert into the small hole in the face of the selector button a resetting tool (see Section 2, Chapter 4, Table 2). Exert a

steady pressure on the reset tool to overcome internal spring tension until the UP button rises and the knobbed ring rotates counter-clockwise to its normal position (the knob horizontal to the switch body) under its own internal spring pressure. Ensure that the UP button cannot be depressed using normal finger pressure.

WARNING

Under no circumstances must the knobbed ring be turned past the 60 deg. (or 90 deg.) stop as such action will damage the switch, and may result in inadvertent retraction of the alighting gear. Similarly it is important that returning the UP selector button to normal mode be carried out as detailed. Any attempt to reset it by any other method, or by using a different tool will cause damage to the switch mechanism.

Entrance-door jettisoning mechanism (fig.4)

17. This is contained within the frame of the door aperture at its upper side. It consists of a horizontal shaft carrying a hinge-pin bearer cup at each end; a worm wheel, pinned to the centre of the shaft, is meshed with a worm on the shaft of the door-jettisoning handle. The horizontal shaft is carried in three bearings, one at either end and one, a double bearing, in the centre; the centre bearing, in addition to locating the worm wheel, also forms the bearing for the shaft of the jettisoning handle.

◀ The aft collar of the shaft is designed to stop the shaft at the extremes of rotation (i.e. door safe or unsafe) by abutting integral lugs on the aft hinge assembly. ▶

18. The door carries two hinge brackets on its upper frame, each bracket having a freely rotating hinge-pin which

extends out on either side. The hinge-pins are accommodated in the hinge-pin cups which, in the safe condition, are rotated so that their slots are facing inboard, thereby forming a socket in which the hinge-pins are retained. The position of the hinge-pins relative to the cups is adjusted during initial assembly by guide bolts which project through the inboard face of the bearings and bear on the inner face of the door hinge brackets.

19. When the door is assembled to the fuselage and the mechanism is in the safe condition, the slots of the hinge-pin cups are facing inboard and the

door is retained in its correct position in the door aperture; in this condition the jettisoning handle has been rotated in a counter-clockwise direction. To jettison the door, the handle is rotated in a clockwise direction, thereby revolving the horizontal shaft and hinge-pin cups until their slots face outboard and permit the door to fall away from the aircraft. To facilitate servicing the door may be removed by this means whilst the aircraft is on the ground.

Fire-protection system

20. Refer to Sect.4, Chap.5.

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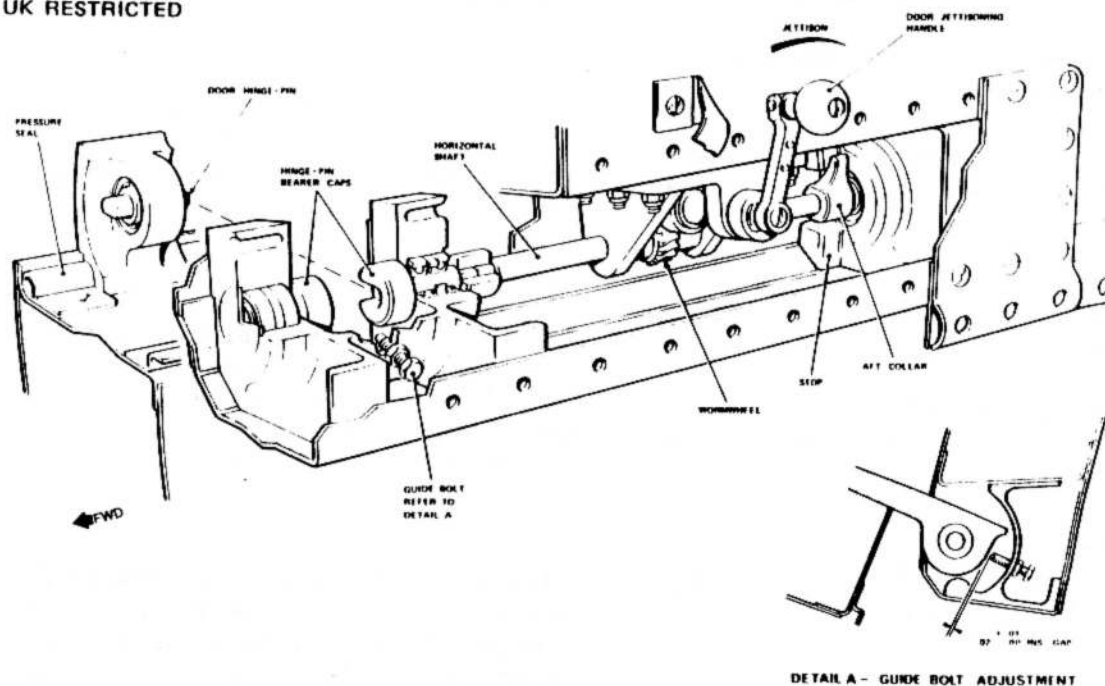


Fig.4. Entrance-door jettisoning mechanism

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

Ejection seats

21. Refer to A.P.109B-0101-1.

Combined time-release and breech unit

22. Refer to A.P.109A-0001-1.

Cocking the snatch unit

23. Refer to fig.1.

Sonar locator beacon

23A. The beacon is located in the port wheel well, attached to the diaphragm, outboard of the wheel well rib.

Cocking the hatch-jettisoning mechanism box

24. Refer to fig.2.

Resetting the alighting-gear and bomb-doors emergency controls

Note...

Ensure that the aircraft is raised on jacks before resetting the alighting-gear emergency control.

25. Exhaust hydraulic pressure and electrically select the alighting-gear actuator to UP, or the bomb-doors actuator to CLOSED before resetting the

emergency control. Both procedures are similar. In the case of the alighting-gear control, press in the ends of the spring lock in the shaft and push the handle into its housing; in that of the bomb-doors control, move the leaf-spring out-board and return the handle to the up position. After resetting the controls, lock the handles in position with 0.355 mm enamelled copper tell-tale/restraint wire; check that the levers on the respective selectors have been returned to the off position and that they are bearing on their stops. Repack the sealing washers where the cables pass through the pressure bulkhead (para.25A). Carry out a functional test of the normal system for correct operation.

Lubrication

25A. Following operation of the alighting gear lowering emergency control, impregnate the sealing washers where the cable passes through the pressure bulkhead as detailed in Chap.8A. Grease with XG-287 the operating cable and handle mechanism. For lubrication details of the entrance door and flying controls refer to Chap.1 and Chap.4 respectively.

REMOVAL AND ASSEMBLY

Ejection seats

26. Refer to A.P.109B-0107-5.

Snatch unit

WARNING

Some Control Column Snatch Units have been fitted with a shortened snatch rod to overcome

rigging problems. Whenever a CCSU is removed or refitted the ADD Log of the aircraft concerned is to be consulted to ensure that an EA approved concession has been granted and recorded. Under no circumstances is a standard rod to be fitted in lieu of a shortened rod or vice versa.

Removal

27.

(1) Remove fuse 15 from the M.E.P. and disconnect the emergency battery.

(2) Remove the time-release and breech unit cartridge (A.P.109A-0001-1).

(3) Remove the forward inboard side panel from the pilot's console.

(4) Remove the elevator severance unit detonator (para.30 (1-4)).

(5) Disconnect the microswitch electrical leads at the six-way terminal block.

(6) Remove the locking wire and disconnect the gas pipe from the valve piston chamber.

(7) Remove the stiffnut and washer and disconnect the snatch rod from the elevator control lever.

(8) Remove the split pin from the tubular-casing forward-retaining pin and withdraw the retaining pin from the mounting bracket.

Assembly

28. This is the reverse of the removal procedure but the following points

should be noted:-

(1) The microswitch clearance is to be as shown in fig.1 and cables routed as in fig.6.

(2) After assembly make electrical checks (Sect.6, Chap.12).

(3) The snatch unit may be tested as detailed in the relevant Servicing Procedure detailed in A.P.101B-0417-5A3.

29. Upon completion of the instructions detailed in the previous paragraph, and whenever the elevator control circuit is readjusted or the snatch unit is test fired and reset:-

(1) Move the control column aft until the elevator bulkhead stop is contacted, at the same time closely observing the sear return spring and the sear operating lever on the snatch unit for movement.

(2) Movement indicates that the snatch rod is fouling the sear which may result in premature operation of the snatch unit. Where movement is found, check, and if necessary adjust, the setting of the elevator bulkhead stops (Chap.4).

(3) Check by applying hand pressure to the snatch-unit rod that, with the control on the bulkhead stop, it is capable of a minimum of 0.0625 in. free travel between contacting the end of the slot in its attachment fitting at the elevators control lever, and contacting the sear. If necessary adjust the length of the snatch rod (para.6).

Elevator control rod severance unit*(fig.5)**Removal***30.**

- (1) Disconnect the normal, emergency and ground electrical supplies (*Sect.5, Chap.1, Group P*).
- (2) Remove the centre access panel from the inboard side of the pilot's console.
- (3) Disconnect the detonator cables at the terminal block mounted on the control rod.
- (4) Unscrew the detonator securing nut and remove the detonator from the detonator housing.

WARNING

Before handling detonators, refer to the LETHAL WARNING card at the beginning of this book.

(5) Ensure that red bands have been painted in the correct positions on the control rod on either side of the severance unit assembly. Renew paint if necessary.

(6) Supporting the lower section of the explosive collar, remove the securing nuts and bolts and remove the two sections of the explosive collar from the control rod.

Assembly

31. This is a reversal of the removal procedure (*para.30*) but great care should

be taken to ensure that fig.5 dimensions and instructions are strictly adhered to and the following points noted:-

- (1) When tightening the explosive collar securing nuts care should be taken to pull the nuts up evenly to prevent damage to the foil covering the explosive filling.
- (2) Ensure that the detonator rests on the explosive filling before tightening the detonator securing nut. For information on the assembly of the detonator refer to A.P.110N-0300 series.
- (3) After refitting the access panel, removed in para.30(2), move the control column through its full fore-and-aft travel to ensure that the severance unit assembly does not foul the access panel or surrounding structure.

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ASSEMBLY NOTES
NOTE

1. LOCATE THE TERMINAL BLOCK AND CLAMP ASSEMBLY AS ILLUSTRATED AND SECURE IN THE VERTICAL POSITION. (THE VERTICAL POSITION IS DETERMINED BY ROCKING THE ELEVATOR CONTROL ROD ABOUT ITS LONGITUDINAL AXIS AND SETTING IT IN THE MID POSITION).
2. PAINT THE RED BAND ADJACENT TO THE CLAMP ASSEMBLY.
3. LOCATE THE EXPLOSIVE COLLAR IN THE VERTICAL POSITION HARD UP AGAINST THE TERMINAL BLOCK, TIGHTEN THE SECURING NUTS UNTIL THE RUBBER SPACERS BULGE AND THE EXPLOSIVE COLLAR IS SECURE AGAINST MANUAL ROTATION.
4. AFTER CONNECTING THE DETONATOR CABLE SECURE EXCESS CABLE AS ILLUSTRATED. (USE TYTON STRAPPING 5E/1147500 AND STUDS 5E/1147501).
5. WHEN CONNECTING THE INPUT CABLE ALLOW JUST SUFFICIENT SLACK BETWEEN THE TERMINAL BLOCK AND CLIP TO ALLOW THE CONTROL ROD TO MOVE TO THE FULLY FORWARD POSITION WITHOUT CAUSING TENSION OF THE INPUT CABLE.

WARNING

1. GREAT CARE IS TO BE EXERCISED DURING EXPLOSIVE COLLAR FITTING, REMOVAL AND LOCATING OPERATIONS TO PREVENT DAMAGE TO THE FOIL COVERING THE EXPLOSIVE FILLING ON THE INNER PERIPHERY OF THE COLLAR.
2. TIGHTEN DOWN THE DETONATOR SECURING NUT FINGER TIGHT ONLY. EXCESSIVE FORCE WILL CAUSE BULGING OF THE FOIL ON THE COLLAR.

DETAIL A
SECTION THROUGH
EXPLOSIVE COLLAR

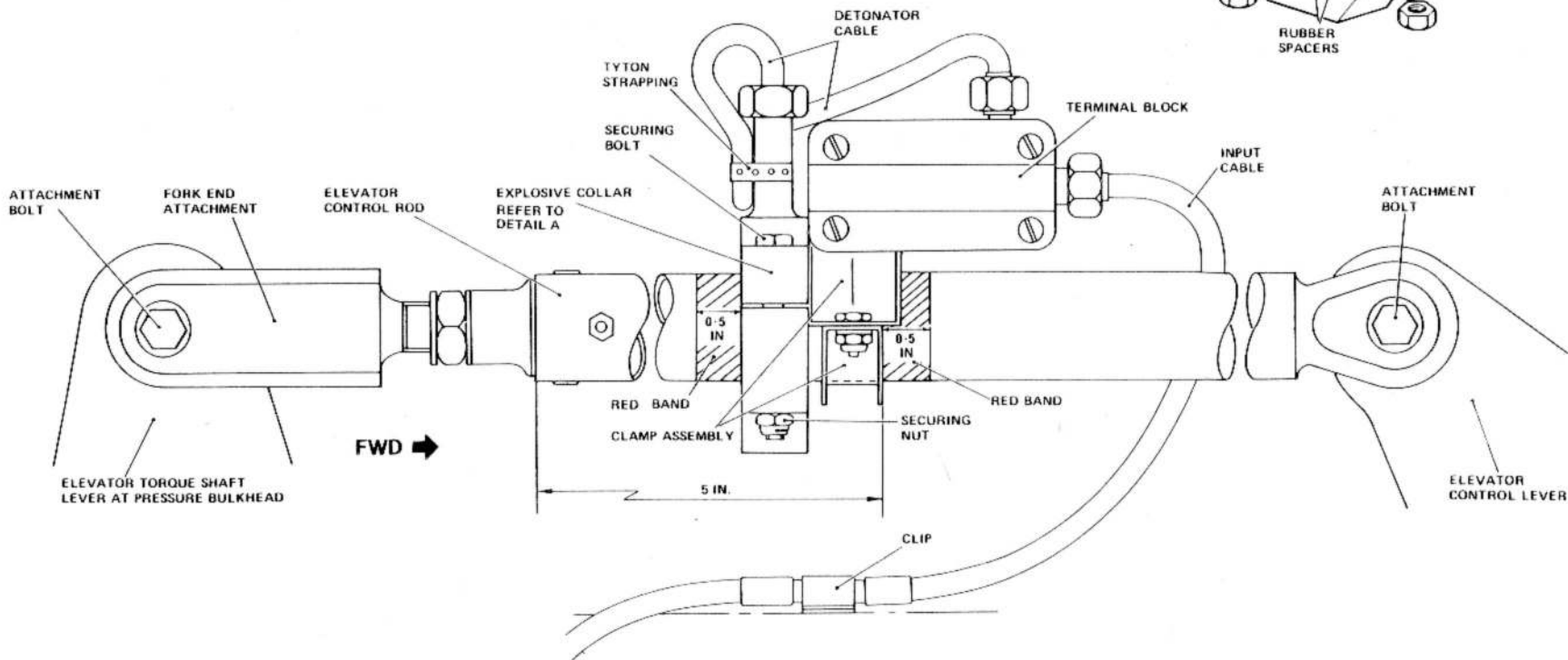
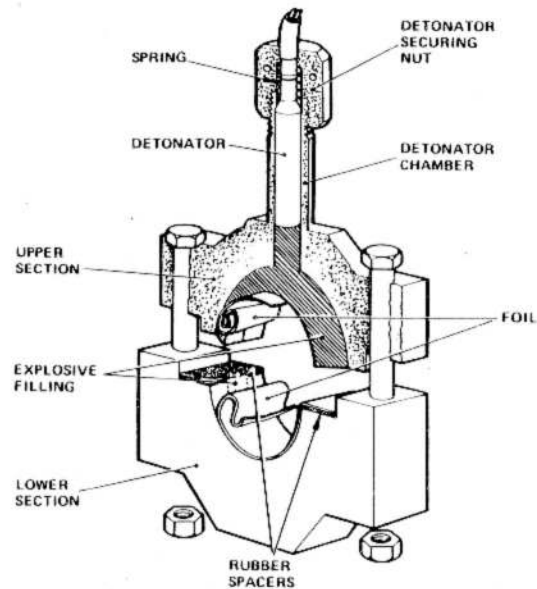


FIG.5. ELEVATOR CONTROL ROD SEVERANCE UNIT ASSEMBLY

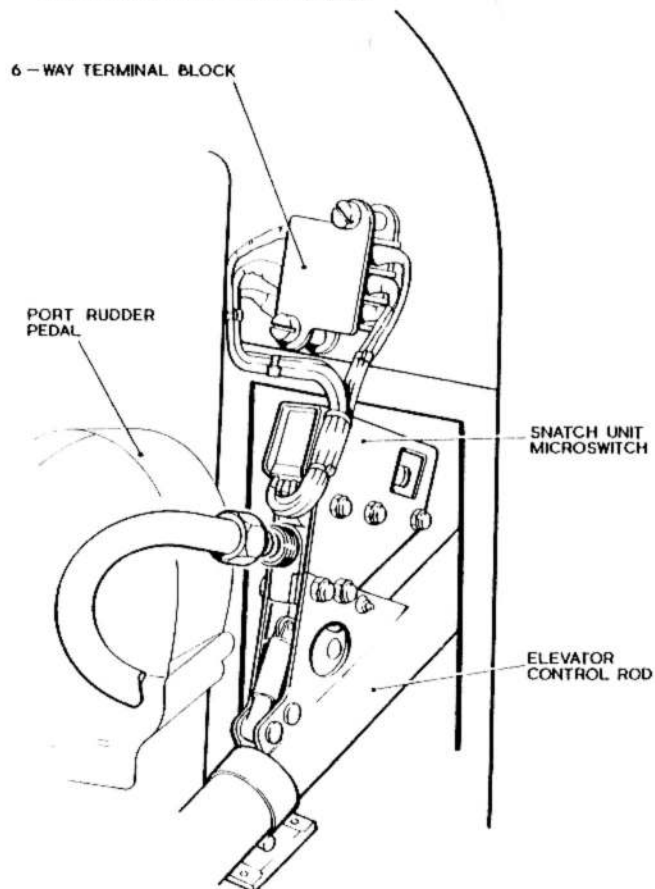
ASSEMBLY NOTES

WHEN CONNECTING A SNATCH UNIT MICROSWITCH AND/OR ELEVATOR DETONATOR TO THE 6-WAY TERMINAL BLOCK PROCEED AS FOLLOWS:-

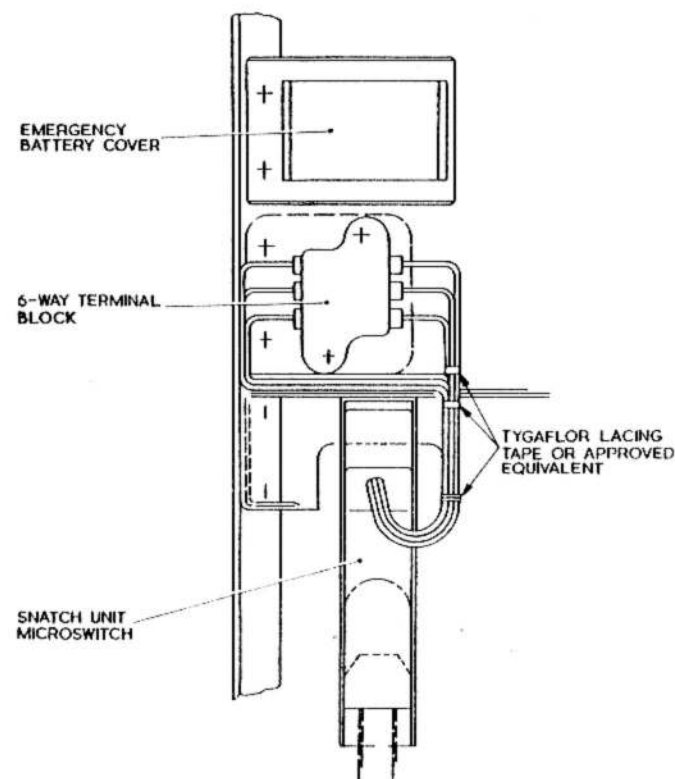
1. ROUTE CABLES OUTBOARD FROM THE MICROSWITCH TO THE TERMINAL BLOCK AS SHOWN.
2. CABLES ARE TO BE CUT TO THE MINIMUM LENGTH REQUIRED TO REACH THE TERMINAL BLOCK.
3. BIND CABLES TOGETHER AND WHERE POSSIBLE BIND TO ANY ADJACENT CABLES TO KEEP IN POSITION.
4. WHERE NECESSARY CRIMP NEW 4BA TAGS, HELLERMANN REF. HE.294 TO RELEVANT CABLES.

WARNING

ENSURE THAT THE CABLES ARE ROUTED AND SECURED SO THAT THEY CANNOT PROTRUDE INTO THE PILOT'S FOOTWELL BEYOND THE EMERGENCY BATTERY ACCESS PANEL.



ELEVATOR SNATCH UNIT MICROSWITCH WIRING
VIEW LOOKING AFT PORT SIDE



ROUTING OF CABLES

FIG. 6 CONTROL COLUMN SNATCH UNIT - CABLE ROUTEING

◀ NEW ILLUSTRATION ▶

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